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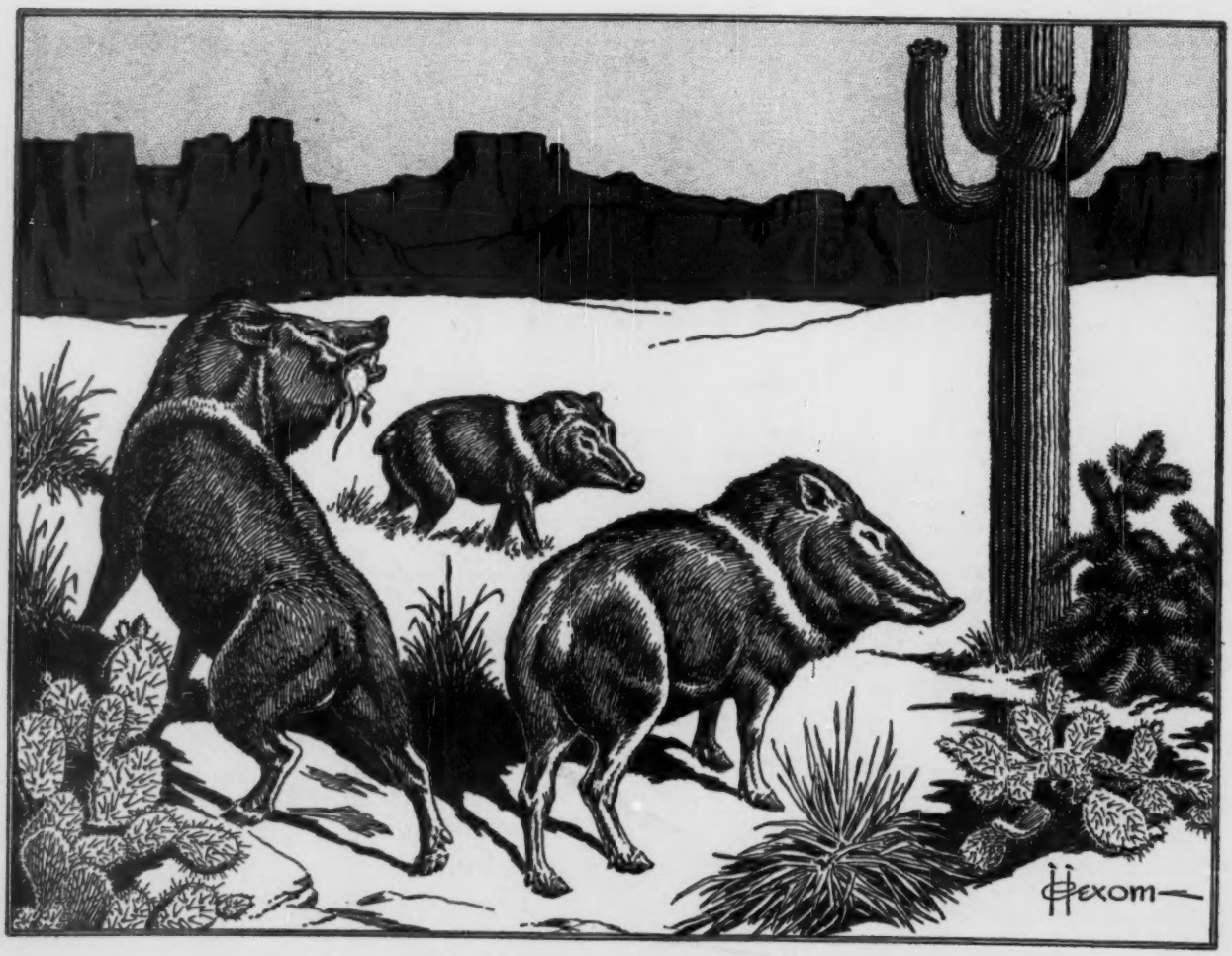

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Published by the AMERICAN NATURE ASSOCIATION to stimulate public interest in every phase of nature and the out-of-doors, and devoted to the practical conservation of the great natural resources of America.

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Briefly Noted

The Angler's Companion. By Bernard Venables. New York. 1958. The Macmillan Company. 224 pages. Illustrated in color and black and white. $12.00. A modern counterpart of *The Compleat Angler*, with information on both fishes and fishing.

Biology and Human Progress. By Louis Eisman and Charles Tanzer. New York. 1958. Prentice-Hall. Second Edition. 544 pages. Illustrated. $4.80. Revised edition of this excellent and interestingly presented textbook.

Embryos and Ancestors. By Sir Gavin de Neer. New York. 1958. Oxford University Press. 197 pages. $4.00. Third and revised edition of this important discussion of embryology and evolution in the light of recent research.

The Cabin at Medicine Springs. By Lulita Crawford Pritchett. New York. 1958. Franklin Watts, Inc. 195 pages. Illustrated by Anthony D'Adamo. $2.95. Story for the teen-age reader laid against a background of an earlier day in Colorado.

Pruning Made Easy. By Edwin F. Steffek. New York. 1958. Henry Holt and Co. 120 pages. $2.95. Practical guide to a phase of horticulture on which too few people are adequately informed.

California Lands. By Samuel Trask Dana and Myron Krueger. Washington 6, D. C. 1958. American Forestry Association. 308 pages. $4.50. Two distinguished foresters collaborate to produce this important study of land ownership, use and management in the State of California.

1001 Questions Answered about Astronomy. By James S. Pickering. New York. 1958. Dodd, Mead and Co. 420 pages. Illustrated. $6.00. Assistant Astronomer at the Hayden Planetarium in New York answers the most-asked questions about astronomy.

Flora Hawaiiensis. By Otto Degner. Book 5. Mokuleia Beach, Waialua, Oahu, Hawaii. 1958. Published by the author. Fifth book in this excellent botanical assembly of information on Hawaiian flora.

Morphogenesis. By Chr. P. Raven. New York. 1958. Pergamon Press. 311 pages. $10.00. A survey of the present state of our knowledge on development in the mollusks, both descriptive and experimental.

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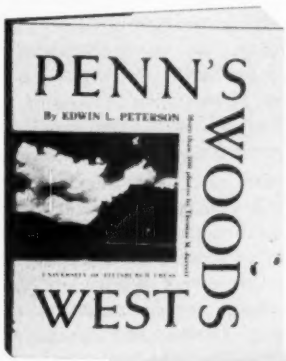
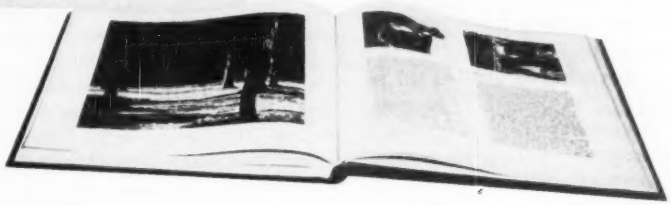


If you like the sound of running waters or of birds singing in the morning, if you like the smell of campfires or of hemlock groves, if you like to drive slowly along a flower-bordered country road on a summer afternoon, you will treasure this book.



PENN'S WOODS WEST

By Edwin L. Peterson; Photographic Editor, Thomas M. Jarrett; 247 pages, 9⅛ x 11¼ inches; 324 photographs (five in full color). Publication made possible by a grant from the Buhl Foundation. **$15.00**

In *Penn's Woods West*, Mr. Peterson tells of the forests and fields and rivers and mountains of Western Pennsylvania. He tells of trout streams, wild flowers, and boys who play hooky to go fishing, of frogs and owls that talk in the night. Mostly he tells of man's dependence upon his environment, whether it be Penn's Woods West or Boston or Elmore County, Idaho.

Gladys Schmitt read the advance proofs and said that Mr. Peterson's writing was "evocative prose whose clarity and flow is the result of seasoned craftsmanship." Jesse Stuart calls it "the finest writing on natural subjects I have read in many a day . . . Henry David Thoreau, I believe, would have liked this book." Joseph Wood Krutch liked it: "A beautiful book — physically and in spirit."

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Nature IN PRINT

By HOWARD ZAHNISER

Journals Of Travel

"THE FIRST EUROPEAN TO REACH the mighty sweep of arctic coast which stretches westward from Hudson Bay to the Siberian Seas" was Samuel Hearne. That was on July 17, 1771. Hearne was in his middle twenties. He was the only white man in his expedition. With a company of Indians he had left Hudson Bay the preceding December, and it was not until after another winter that he "arrived again at Prince of Wales Fort," on Hudson Bay, the 29th of June, 1772. Twice before he had failed in his attempt to find the reported copper mines near Coronation Gulf, far to the northwest of the English outpost on Hudson Bay. And then, as Farley Mowat tells us, "he walked close upon 5000 miles through one of the most forbidding territories in the world—a land so harsh that the last of his major areas of discovery was not revisited by white men until the 1920's."

"These accomplishments," Mr. Mowat continues, in a foreword to republication of Hearne's journals, "give something of his external measurements." Yet, he points out, these accomplishments "do not indicate the full stature of the man, for the smallest part of greatness in an explorer," says Mr. Mowat, "is not his proficiency at discovering new seas and lakes, rivers and bays, mountains and plains."

"The living features of an unknown country," Mr. Mowat perceives, "those aspects which ebb and flow with the impermanence of life itself, these are the true revelations of the nature of new worlds. These are the aspects which the first beholder must seize on and preserve—not in a state of dead suspension, but in a state of life. To give some measure of immortality to these transient things requires genius."

"Hearne possessed it," Farley Mowat assures us: "he was able to defeat the years and to bequeath to us a living monument out of a vanished time."

Limited printing

That monument is his journal, published in 1795. Amazingly enough, it has previously been reissued only once—in 1911—in an edition of only 500. It was my privilege to read one of these in the library of Edward Preble, who himself was first to revisit (on his Athabaska-McKenzie biological investigations only half a century ago) some of the scenes of Hearne's journeys. I had no idea that Hearne's journal was so far out of reach of so many other readers, and I have indeed welcomed and thrilled to this excitingly readable and informative volume recently published by Little, Brown & Co.: *Coppermine Journey: An Account of a Great Adventure—Selected from the Journals of Samuel Hearne by Farley Mowat.*

The year after Hearne had returned to his outpost from that wild journey to the north another traveler with the prerequisites that Farley Mowat outlines for genius left the eighteenth century American center of learning, charm, and commerce in Philadelphia, and embarked on explorations of unknown country to the south. That, of course, was William Bartram, "first beholder" who did indeed "seize on and preserve" the nature of his new world "not in a state of dead suspension, but in a state of life."

Four years before Hearne published his journey's account in London in 1795, William Bartram had seen his journals published in Philadelphia, with the title descriptive, if not short—*Travels Through North & South Carolina, Georgia, East & West Florida, the Cherokee Country, the Extensive Territories of the Muscogulges, or Creek Confederacy, and the Country of the Choctaws; Containing An Account of the Soil and Natural Productions of Those Regions, Together with Observations on the Manners of the Indians.*

Probably there is nothing more important for a reviewer to say descriptively about these journals than to testify that the title is indeed right, but one must hasten to add that the vitality of Bartram's observations and the revelation and charm of his narrative are in keeping with his precious opportunities as a pioneer in travel. An observant, articulate botanist and naturalist, William Bartram was inspired with the conviction that "this world, as a glorious apartment of the boundless palace of the sovereign Creator, is furnished with an infinite variety of animated scenes, inexpressibly beautiful and pleasing, equally free to the inspection and enjoyment of all his creatures."

Bartram honored

William Bartram has doubtless been known by appreciative readers with a quest for his information or a taste for his charm or romantic stimulus ever since his first publication, but he never has been so thoroughly honored or so respectfully printed and annotated as he has been this year in a new volume entitled *The Travels of William Bartram: Naturalist's Edition: Edited with Commentary and an Annotated Index by Francis Harper.*

Nearly twenty years ago, Professor William H. Mills of Clemson College wrote Francis Harper: "I hope that you will make Bartram live again." Surely the hope has been remarkably well realized, for, in the midst of the most comprehensive equipment of scholarship, William Bartram's authorship is vital and heroic.

In a volume of nearly 800 compact and attractive pages, "Bartram's *Travels* is here republished in such form that it may be consulted, quoted, and cited with practically the same exactness as if it were the original edition of 1791," its former paging being shown in italic numbers in the present text. Yet the additions to the original work comprise more than half the present remarkable volume. In addition to its preface, and its excellent illustrations, this new work, in Francis Harper's summary, consists of—

". . .an introduction, containing an account of Bartram's life and his *Travels;* a commentary on geographical, historical, and various other matters that could not be so conveniently or so adequately discussed elsewhere; an Annotated Index, providing, among other things, identifications of Bartram's plants and animals, biographical notes on persons, definitions of unusual or familiar terms, information on Indian tribes, and the location of geographical features; a bibliography of publications, manuscripts, maps, and atlases; a section on variant orthography, punctuation, and composition; a general index to the preface, introduction, and commentary and to certain words in

the annotated index that do not constitute first position entries; and various maps and figures inserted at the end of the volume."

Francis Harper, in all thoroughness, competence, and scholarship has nonetheless annotated, edited, and commented in humility and such respect and regard that his author lives brighter than before, undimmed by his sophisticated interpreter.

The "lost" journals

One wonders about this while reading a third volume of journals—"lost" journals written in 1840 and 1841 by Henry David Thoreau and never, before 1958, published. One reads 130 pages of "Introduction" or ever he reaches these never-before-published journals, and wonders if the Harvard scholar who explains Thoreau in this "introductory" discussion, which comprises indeed an admirable essay or treatise, has for his author much at all of the esteem and regard that Francis Harper shows for Bartram. "The Journal" itself occupies only eighty-six pages, including further annotations that require some twenty percent of even this space. Even the title of the volume is a new creation, and one wonders what curious inspirations or apprehensions moved publisher and editor, for the editor is the eminent and valid scholar and interpreter Perry Miller, and the publishers Houghton Mifflin.

Consciousness in Concord, for that is indeed the title of this volume, has a descriptive subtitle: *The Text of Thoreau's Hitherto Lost Journal (1840-1841) Together with Notes and a Commentary by Perry Miller.*

In its journals Thoreau comments that "to travel and 'descry new lands' is to think new thoughts, and have new imaginings."

"In the spaces of thought are the reaches of land and water over which men go and come," he reflects, and then he concludes this August 13th, 1840, paragraph:

"The deepest and most original thinker is the farthest travelled."

There are similarly rich and rewarding reflections in these rediscovered "lost" portions that make them indeed a piece with the rest of Thoreau's great journal, and they can be enjoyed again—perhaps sometime in a volume of their own, slim as it may be.

For now, however, these sample comments of Thoreau on travel seem fitting for accompaniment to Samuel Hearne and William Bartram—whose republished journals by much chance and some choice came to us with these pages that remind us of Thoreau's good deal of travel in Concord.

Consciousness in Concord: The Text of Thoreau's Hitherto "Lost Journal" (1840-41) Together with Notes and a Commentary by Perry Miller. Boston: Houghton Mifflin Co. 1958. xii + 243 pp. (5¾ by 8¾ in.) with index. $4.00.

Coppermine Journey: An Account of a Great Adventure—Selected from the Journals of Samuel Hearne, by Farley Mowat. Boston: Little, Brown & Co. 1958. xiv + 145 pp. (5½ by 8¼ in.), with foreword by Farley Mowat, biographical prologue and epilogue, and end-papers map by John H. Matthews of Hearne's Journeys 1770-1772. $3.75.

The Travels of William Bartram. Naturalist's Edition. Edited with commentary and an annotated index. By Francis Harper. New Haven: Yale University Press. 1958. lxi + 727 pp. (6¼ by 9½ in.) with introduction, references (including manuscripts), list of maps and atlases, appendix listing "variant or incorrect orthography, punctuation, and composition," frontispiece from portrait of William Bartram by Charles Wilson Peale, 13 full-page reproductions of pages from 1791 edition, 29 photographs on 15 pages, folding map of Bartram's routes, "Taitt" map of 1772 redrawn in 3 one-page sections, and general index. $8.50.

The Birds

By Oskar and Katherina Heinroth. Ann Arbor, Michigan. 1958. University of Michigan Press. 181 pages. Illustrated. $5.00.

This book is as useful and interesting to the beginner as a student of birds as it is to more advanced ornithologists. A vast amount of information is packed into a small package, and this includes some most interesting and surprising data.

Publication Delay

Nature Magazine has been advised by the Viking Press that, due to production difficulties, the publication of two of its books, advertised in our October issue, has been delayed. These are *An Adventure in Astronomy*, by Kenneth Heuer, postponed until Nov. 7, and *Satellite of the Sun*, by Athelstan Spilhaus, postponed until later in November.

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Reviews

Penn's Woods West

By Edwin L. Peterson. Pittsburgh, Pa. 1958. University of Pittsburgh Press. Illustrated with more than 300 photographs by Thomas M. Jarrett. 249 pages. $15.00.

This beautiful book is one of a group of volumes on the cultural history of western Pennsylvania made possible through a grant-in-aid from the Buhl Foundation of Pittsburgh. There is a "peculiar magic" in the climate of the region where the Allegheny, Monongahela and the Ohio rivers meet in western Pennsylvania, writes A. W. Robertson in an introduction. Here "the climate of the southland met and mingled with the temperate zone, and fruits and flowers, shrubs and trees, indigenous to both regions, mingled in luxuriant growth." The region has yielded great wealth, but today is as much appreciated for its valleys and hills as for its economic significance. In planning this splendid volume the author has chosen to deal with western Pennsylvania seasonally, starting with spring. He weaves history of the past with the story of the area as it is today, all in a delightfully written text. The photographer has caught the spirit of the author's text and, with the collaboration of the printer, a fine large-sized volume that does full justice to western Pennsylvania is the result. There is a great deal of natural history in the text, as well there must be since the region is rich in Nature.

R.W.W.

Double or Nothing

By Phoebe Erickson. New York. 1958. Harper and Brothers. 128 pages. Illustrated by the author. $2.75.

This latest children's book from the typewriter and drawing pencil of this talented author-illustrator is a charming dog story. Indeed, it is a two-dog story, for the dogs that became the pets of Jeff and Ellen Gates were twins. This book should make a great hit with all dog-loving youngsters, which assures it a wide market.

Wildlife of the Intermountain West

By Vinson Brown, Charles Yocom and Aldine Starbuck, San Martin, California. 1958. Naturegraph Co. 144 pages. Illustrated. $2.50.

This is the fourth in the American Wildlife Region Series being brought out by this company. Its scope is the Palouse of eastern Washington, northeastern Oregon, west central Idaho and south central British Columbia, as well as the Great Basin plateau region between the Rockies and the Sierra Nevada. The close identity between the fauna and flora of these two areas justify such joint coverage.

Discovering Nature

By Charlotte Orr Gantz. New York. 1958. Charles Scribner's Sons. 239 pages. Illustrated by Charles Hargens. $3.95.

The author sub-titles this charming book "An Introduction to the World Outside." A student and a collector of things of Nature, the author started as a child to use the seeing eye and apply her curiosity to what she met outside. This, then, is a well-written story of her travels here and there and of Nature as she met her.

Simba of the White Mane

By Jocelyn Arundel. New York. 1958. Whittlesey House. 127 pages. Illustrated by Wesley Dennis. $2.95.

Toki was a small African boy who had cherished a desire to travel with a safari into the wild. Finally he saw his opportunity to hide in one of the supply trucks and managed to escape discovery until it was too late to return him to his native village. This, then, is the story of a safari as seen through the eyes of the youngster. Miss Arundel has been on safari herself, and the artist was a member of the same party. While this book is for the younger reader we found it most pleasurable to read, no doubt because of Miss Arundel's deep appreciation of animal life and the authenticity as well as the competence of her prose.

R.W.W.

Wild Folk in the Desert

By Carroll Lane Fenton and Evelyn Carswell. New York. 1958. The John Day Company. 128 pages. Illustrated by Dr. Fenton. $3.50.

In this book the authors introduce the younger reader—ages four to twelve—to the interesting wild animals of desert regions in the United States. The circumstances under which these creatures live make their lives different from their relatives elsewhere. Thus this book is not only devoted to desert life but to the desert itself and the influences it exerts.

Snakes in Fact and Fiction

By James A. Oliver. New York. 1958. The Macmillan Company. 199 pages. Illustrated. $4.95.

In effect this book is an extension of a chapter in Dr. Oliver's earlier book, *The Natural History of North American Amphibians and Reptiles.* In that volume he briefly discussed the folklore and old wives' tales about reptiles. Here he goes into greater and most interesting detail to expose serpent hoaxes and misconceptions and to present herpetological fact as established by explorers and biologists.

NOVEMBER'S AUTHORS

John Holdsworth

Jack Van Coevering

In this issue, John B. Holdsworth of Crystal City, Texas, tells how, during the second world war, the Army "invited" him to a sojourn at Cold Harbor, at the tip of the Alaska Peninsula, and how he passed his leisure hours in the observation of Nature around the air base there. . .free-lance writer Joseph Bernstein, a native of Brooklyn and now a resident of Queens, New York, has been in times past a social worker, a Federal labor law investigator, and an oceanographer with the U. S. Navy Hydrographic Office; Mr. Bernstein, now a medical advertising copy writer, has produced many spare-time articles for national publications, with emphasis on natural history and oceanography. . .John Lindsey Blackford, a frequent contributor to our pages in the past, is a naturalist, writer and photographer who lives in Libby, Montana. . .Henry Clepper, widely known and well-traveled forester, is secretary of the Society of American Foresters, publishers of *Journal of Forestry*, whose headquarters are in Washington, D. C. Mr. Clepper's home is in Arlington, Virginia. . .Jack Van Coevering, wildlife editor for the *Detroit Free Press* since 1931, is a magazine article and story writer, chairman of the board of the Outdoor Writers Association of America, and producer and photographer for the TV show "Adventure Out of Doors." His home is at Orchard Lake, Michigan. . .E. John Long, who specializes in articles on scientific subjects, is a former resident of Bethesda, Maryland, now employed in an educational capacity at the marine laboratory of the University of Miami at Coral Gables, Florida. . . Alice L. Hopf is a resident of New York City, a member of the New York Entomological Society and the Lepidopterists' Society, and free-lance writer with a hobby of breeding lepidoptera.

Contents noted BY THE EDITOR

CONSERVATION IN THE 85TH CONGRESS, while not distinguished by its quantity was reasonably good in quality. All legislation that was not acted upon lapsed, of course, and must be reintroduced in the 86th Congress. Thus the legislative mills seem to grind slowly, but there has been a steady growth in the number of informed and dedicated conservationists among the members of the Senate and House. It is to be hoped that all of these members will be returned to office in November.

A LAW TO RESTRICT OUTDOOR ADVERTISING on the mileage of the system of Interstate and Defense Highways was a significant accomplishment. While not strong legislation, this measure affirmed a principle and charted a course for the States to follow through legislation affecting the highways within their borders. The President signed this measure into law with the observation that it should be strengthened, and this is a task that remains for the incoming Congress to perform.

AN OUTDOOR RECREATION RESOURCES REVIEW COMMISSION was created to coordinate information and to provide a complete picture of our assets in the area indicated by the name of the Commission. This includes the recreational resources of national parks and forests, wilderness areas, wildlife refuges, State parks and forests, seashores, community parks, and other areas. Assembling such information should reveal the impact of recreation demand and the present and potential resources that we have to meet this demand. Obviously we must plan wisely for the future, faced as we are by steadily increasing population.

INADEQUATE HABITAT FOR MIGRATORY WATERFOWL brought about the enactment of a law increasing the Migratory Bird Hunting Stamp—or Duck Stamp—from two to three dollars and earmarking the income it yields for acquisition of wetlands for these birds. The law increases from 25 percent to 40 percent the area of wildlife refuges that may, at the discretion of the Bureau of Sport Fisheries and Wildlife, be opened to public hunting. We would have preferred not to see such an increase, and we hope that the Federal agency will exercise restraint in using this authority.

PROBLEMS CONNECTED WITH CHEMICAL POISONS of various kinds have become increasingly apparent. It is obvious that the widespread and often unwise use of these pesticides constitutes a threat to wildlife, domestic animals, human life and, indeed, the whole biotic community. Application of these poisons has been carried on with woefully inadequate knowledge of their effects, both immediate and long-range, on other forms of life beyond those that the poisons are intended to control. Legislation was, therefore, passed authorizing intensive study of the whole area of poison use, although the law did not appropriate funds for the purpose. This was provided for through supplemental appropriation. Delay could be serious as these chemicals become more and more potent and more and more widely applied.

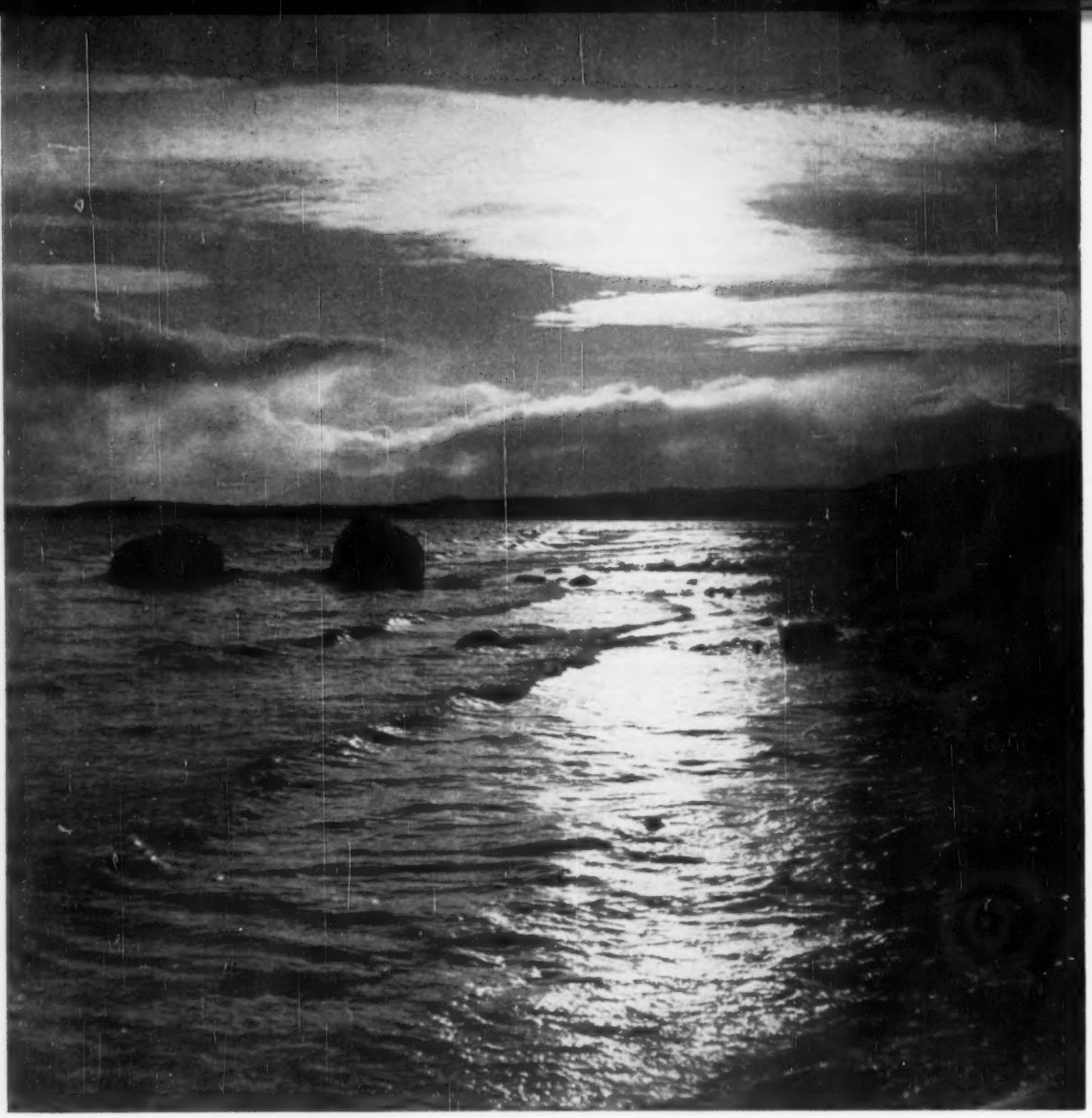
AMENDMENT OF THE COORDINATION ACT was an important piece of legislation. This makes possible far greater concern for and attention to the preservation and enhancement of wildlife and fish resources in connection with dam-building and other water projects. Hitherto little attention has been given to the impact of such programs on wildlife values, which are obviously inherent in such activities.

HUMANE SLAUGHTER OF DOMESTIC ANIMALS took a step forward through the enactment of a law that will require that animals yielding meats purchased by the Federal Government be thus dispatched. This is not a strong law, lacks enforcement provisions and penalties, but does have the virtue of affirming a principle and endorsing a practice already in vogue with some companies.

A LAW TO CREATE A WILDERNESS SYSTEM within the framework of existing Federal agencies lapsed with the closing of the 85th Congress. Nevertheless hearings on this bill were held in both the Senate and the House. This resulted in a great deal of education on the issue, both among members of Congress and the public generally. It also brought about the clarification of the proposed law, through modification and amendment, to the point that a major proportion of the opposition to the measure has vanished. With the progress that has been made during the past two years there is every hope that this important legislation will receive favorable action by the incoming Congress. This is a bi-partisan measure that enjoys the endorsement of many members in both Senate and House.

THE CONSERVATION RECORD OF LEGISLATORS is being more and more scrutinized by voters as the number of active and informed conservationists grows. Members of Congress are well aware of this, and this awareness constitutes a greater hope for our natural resources.

R.W.W.



Not far south of the air base at Cold Bay, at the tip of the Alaska Peninsula, is Frosty Peak, dominating an autumn afternoon beach scene from behind the low-lying clouds.

A narrow brook cut across the tundra near Mount Simeon—actually a hill rising only a few hundred feet—and along the brook the author and his friend found the flowers of the lupine.

Cold Bay, at the tip of the Alaska Peninsula, is the

Gateway to the Aleutians

By JOHN B. HOLDSWORTH

Photographs by the Author

A common Aleutian flower is that of the salmonberry, member of the rose family and producer of an edible fruit.

MANY A VETERAN of the second world war knows the setting for the prelude to this story. Perhaps, like me, he remembers the cryptic wording stenciled on the olive-drab paneling, the ever-present webbing straps—what a lot of webbing it takes to hold an army together!—the untidy heap of duffle bags, the very tidy arrangement of survival equipment, the folding benches with slight depressions the only concession to a human cargo. . . and, of course, the noise, the vibration—and the cold. Especially do I remember the cold that night I was shipped to Cold Bay, Alaska. I was with a small group of army travelers, all strangers to me at the time of the weighing-in and the lecture on "ditching." That was back in Anchorage, and now the C-47 was nearing Cold Bay and the tip of the Alaska Peninsula, a place that had the reputation of being one of the least desirable for a tour of duty. I had no doubt that I would be welcomed enthusiastically by at least one person there—the weather observer I was going to replace! We were all a pretty glum lot, I suppose, with varying degrees of apprehension burgeoning within our well-upholstered bosoms.

There was nothing but darkness outside in that almost uninhabited corner of the continent. We had been traveling for some three hours now, and I had long ago withdrawn as far as possible into my parka to wait out the trip. Then I noticed several of my companions peering intently out of the windows. At first, I saw nothing, but presently an eerie scene began to take shape. It was about at our level, a dull red, indefinite patch of light that rapidly gained intensity, and then as quickly faded away. It was almost as though a smoker was taking a long draw at a cigarettet, just outside the window.

Evidently one of the men had been that way before. I caught the word "volcano." Such was my introduction to Pavlof, a natural beacon for Cold Bay, some forty miles farther on. In a matter of minutes we put down at the base, and, as we stood on the runway apron waiting for instructions, the mountain still could be seen breathing fire with slow regularity across the water.

Next morning, the good weather was still with us. Pavlof, by day, was even more striking. Nearer than that 8900-foot volcano—although the loss of perspective with distance made them seem adjoining—were the

This is Cold Bay, looking east toward Pavlof Volcano and the Aghileen Pinnacles, just to the left of Pavlof, a sawtooth rampart left by some older eruption of the mountain.

Along the sea cliff at Cold Bay grew the Kamchatka rhododendron, *Azalea camtschaticum*, a dwarf species of this far-flung genus of plants.

Aghileen Pinnacles, a great, freakish, saw-toothed rampart left by some more ancient eruption. These mountains were always more or less snowy, and stood out with great boldness and intensity whenever the sky cleared. There was practically no haze, so that distant scenes did not assume the usual bluish cast, nor was there any appreciable unsteadiness of the atmosphere from heating.

In the other direction, the summit of an even more distant volcano might be seen just as clearly. This was the almost perfect cone of Shishaldin, some sixty miles away on Unimak Island. Rising 9400 feet, it was the highest point in the Aleutians. Pavlof lacked this classical symmetry—it was not a picture-book volcano—and it had, as a result, more character. Every three minutes or so, it emitted a small puff of brown smoke, which at night reflected the glow within the crater and produced the fireball effect we had seen from the plane. Occasionally there was a perceptible increase in its activity. There are even one or two records of fairly lively eruptions, although apparently none of a disastrous nature.

We were not on an island proper, although the climate and topography of the area are typically Aleutian. Actually, the bay does not lack much of being a strait, its Pacific water reaching within a few thousand yards of the Bering side of the peninsula. While Aleutian weather is notoriously disagreeable, it is not particularly cold. The temperature in winter averages a little above freezing, and never falls to zero. The fact is, however, that the summers are not much warmer. The average is at that time around fifty, while anything higher than sixty is rather unusual. It is, in short, an oceanic climate of wind and wetness and small annual range of temperature. At Cold Bay, there was an added unpleasant feature: the mountains on either side of the harbor had a funneling effect on the winds, and the storms generated by the ceaseless conflict of Arctic and Pacific air masses swept across the bay with concentrated fury.

I have mentioned Pavlof, the volcano—and yet the scenery was actually dominated by another and much nearer mountain. Frosty Peak, just south of the air base, rose with magnificent, craggy abruptness from near sea level to more than seven thousand feet. When the sun shone, the snow fields glistened and the small glacier in a col east of the main peak became a translucent turquoise. Like a high-ranking person of state, Frosty made only occasional public appearances; yet its presence somehow continued to be felt after days of rain and fog. I understood as never before the primitive cult of locating supernatural beings on certain mountains.

Having heard from more than one source that Cold Bay was even worse than the Aleutians, I arrived at my new station with understandable misgivings. And I found it was —yes—just about as they had said. But once I had satisfied myself that it was possible to survive and that the mail came regularly, some interesting sidelights began to divert me. First there was the bay itself, which receded perhaps a quarter of a mile at extreme low tide and left an expanse of blackish sand, gravel and scattered basalt boulders to which clung many forms of marine life. There were beds of rockweed and horse mussels, jellyfishes, and even sponges. Gulls swarmed over the rocks and pools, searching for starfishes, sea urchins and sea cucumbers, and there were often phalaropes, plovers and sandpipers about; once a bald eagle and a great flock of white-fronted geese. All this, except perhaps the dark complexion of the sand and pebbles, makes Cold Bay sound like a typical northern seashore; and, as a matter of fact, that was what made it particularly strange. Whatever we human creatures thought about these cold, gloomy waters and the no less dreary land adjoining, there were apparently many lesser animals that held the region in esteem. However, I was an untraveled product of the Texas plains, and could not accurately compare this with any seacoast but that of the Gulf of Mexico. I suppose it may be unique in various ways, and one may be in the giant kelps of bizarre form that sometimes washed up. The most remarkable was the brown alga *Nereocystis*, with its rope-like stalk many feet long.

The Indian rice-root, or squaw lily, is a plant whose root is sometimes an item of food on the menu of Alaskan natives.

Eventually I was joined by a newcomer, Hopkins, who was interested in making a plant collection. Or, rather, I attached myself to this project, helping with

the collecting, and then photographing the specimens before they were consigned to the press. Along the sea cliff, where the ravens played endlessly and seemingly without effort in the wind that swept up from the bay, we found the dwarf Kamchatka rhododendron and bluebells peeping out of the thick carpet of moss. The cliff yielded more specimens than any other place. Several members of the aster family grew there, as well as the showy narcissus anemone, the squaw lily and the poisonous monkshood.

Hopkins, lately of the geological survey, thought the noticeable rise of the terrain toward the cliff indicated wind-deposited loess, and that this explained the greater fertility of the place, although it is hard to imagine much soil being carried by the wind in such a moist region. Here also were numbers of wild strawberry plants—the genuine article, with a red button of a fruit just large enough to taste. Hopkins confidently sampled almost all other colorful berries he came across, to find out by the most direct method if they were edible. They were, apparently, for Hopkins lived to collect another day.

Once we came upon two graves near the sea, fenced around neatly and marked, in the manner of western civilization, with engraved headstones. The inscriptions were in Russian. How these dead came to be so well remembered in so remote a spot is now a mystery, although, at the time, I thought little about it. There had been people in the area before the army and navy, at any rate; and, as a matter of fact, an old man was at the time living in a cabin not far from the base. He came in occasionally to get a meal at the mess hall, and enjoy a change of company from his usual bear visitors. I never learned how he happened to be living alone in that desolate place. Opinion was that he did not care to discuss the matter. Also, there were a few fishermen at False Pass, about twenty-five miles distant. (The strait separating the tip of the peninsula and Unimak Island was sometimes choked with ice, giving rise to the name of False Pass). But we saw none of these people except when medical attention was required at the tiny base hospital, and away from the base there was the feeling, rare in these times, of a world but lightly touched by the hand of man.

Along the sea cliff were a few grassy knolls or hummocks, and back from them a broad, level stretch of tundra. It was strenuous going across the tundra. We sank ankle deep into the spongy carpet of moss, and the uneven, corrugated nature of the terrain made it impossible to take a regular stride. I have never been able to account for these ridges and furrows. There seemed hardly enough rainfall or drainage of melted snow for appreciable erosion, even if the moss had allowed it. I thought of drifts of sand and volcanic ash formed long ago—a far-fetched notion, since many of the low places were capable of hiding a fox until we were almost upon it.

It was out on the tundra that I watched the vertical flight of the longspur and heard its tinkling melody. That song must be as charming to human ears as to those of the lady longspur, since bird song is a rarity in the Aleutians. I can remember seeing only five land birds during my stay at Cold Bay—the longspur, snow bunting, rosy finch, pipit and ptarmigan. Well, there was the raven, of course, which had taken up scavenging at the base and whose song was anything but inspirational. Said one of my acquaintances, "Sounds like he's going to throw up," and I had to agree.

A narrow brook cut across the tundra, and along it Hopkins and I found the familiar cowslip and monkey-flower, and a lupine that reminded me of the bluebonnets, back in Texas. Orchids in Alaska being almost legendary, the three species we found should have special mention. They were rather unspectacular green, white and maroon flowers, and, needless to say, they were orchids only to the extent of belonging to the orchid family.

Beyond the brook we came to the gentle incline of Mount Simeon, a hill rising a few hundred feet. Part way up was a thicket of the nearest thing to a tree that we encountered. It was a willow, twisted and dwarfed out of easy recognition. There was also a much more diminutive, creeping kind of willow lost among the grass and mosses. Other than these, and a few alders said to sprawl horizontally in places, native trees are

At the base of this moss-capped boulder on Mount Simeon are the dwarf willows, the nearest thing to trees that may be seen in the Aleutian area. In the background is the tundra, a corrugated and spongy carpet of moss that makes ordinary walking next to impossible.

absent in the Aleutians, and those introduced survive feebly, if at all. Yet there is no wholly apparent reason why they should not do tolerably well.

It has been theorized that trees were eradicated by the glaciers of the last ice age, and that present wind systems do not carry the seed from the mainland at the proper season. But this does not explain the failure of efforts to transplant trees, and it may be that the soil has not yet acquired fertility to sufficient depth. In a deep cut near the sea cliff there was complicated brown, white, red, green and black soil stratification, and at least one of the layers was found to be composed largely of the siliceous skeletons of diatoms; while another white layer looked much like powdered pumice from a volcanic eruption.

On the summit of Mount Simeon we once found an area of torn-up earth and the footprints of a brown bear that had probably been digging for a ground squirrel. It occurred to me that the huge animal might be living in the abandoned Quonset hut, nearby, that in the more hectic days of the war served as an observation post. We thought it unwise to investigate, however. Not long before, hikers on Frosty had encountered a bear. A shout from one group to another had brought him out from behind a boulder and sent him pelting away in ridiculous panic. I was reminded that the Indians in Alaska are said to make as much noise as possible when passing through thickets in bear country, so that the "brownies" will move out of their way.

Below us the tundra stretched away in a curious pattern of brown, green and yellow whorls, patched in many places with shallow ponds from a few feet to forty or fifty yards in width. Their level was virtually constant, and they were thickly grown up to horse-tails and fringed with the white plumes of the sedge called "Alaska cotton." Looking away to the north, we could make out Amak Island rising mistily fifteen or twenty miles from the Bering shore. A weather outpost there had once been accompanied by a cat named for the island. If Amak was an ambitious cat, she was perhaps the only one in history to catch the Amak mouse, supposedly found nowhere else in the world. Fog was forming over the Bering, we noted, and before we reached the base it had crept in and enveloped the peninsula.

Late one night in May, our usually lethargic teletype machine suddenly came to life and pounded out a story that began: *Germany surrendered unconditionally to western allies and Russia at two forty-one ayem French time Monday.* The summer wore on. The salmon came into the bay, followed by seals, and the bears fished the little river up the coast. Autumn slipped in gradually, and the short growing season came to an end. Hopkins' pressed specimens were packed and sent home. We concluded that the Cold Bay area was hardly a flower garden. I had negatives of sixty-some species—a rather modest figure, I thought, for so many miles of trudging, and many of these were quite small and scattering. While there were some fairly respectable patches of fireweed, yarrow, lupine and dock, the thick cover of moss and grass apparently kept other plant growth to a minimum. It occurred to me also that the scarcity of flying insects might well be a handicap to the flowering plants.

Finally, another dramatic story broke, about a new, devastating weapon that was bringing the Pacific war to a speedy conclusion. Hopkins mused that it seemed they had something "too hot to handle," but at the moment, nothing mattered a great deal except the prospect of going home. Hopkins, though, seemed to think that it would not be soon. He had acquired a puppy, and was busy housebreaking it when my orders came through.

It was the usual gray autumn day when I boarded the mail plane to Adak on the first leg of that journey. Frosty and the volcano were hidden. The plane turned westward, and the bay and Mount Simeon were lost at once in a swirl of fog. I did not remember when I had last seen Frosty. Now, thirteen years later, with all those people and places and things vanished into the limbo of lost wartime acquaintances, it seems a pity I could not have given that noble mountain a proper farewell salute. ❦ ❦ ❦

WINTER ITEM

(News filler: The polar bear is protected against sliding on the ice by thick hair that grows on the soles of its feet).

The polar bear's great hairy feet
Forestalling slips on ice
Are quite a trick. It's hard to beat
The polar bear's great hairy feat—
But I would rather slide on sleet
Than have, at any price,
The polar bear's great hairy feet
For stalling slips on ice!

John Gallinari Whidding

To the natives of Peru,

El Niño is A Trouble-Maker

By JOSEPH BERNSTEIN

PAN-AMERICAN UNION

Peruvian laborers break up guano deposits for packing. Pacific Ocean, in background, periodically produces rains that wash away thousands of tons of precious guano.

NORTHWARD along the west coast of South America flows an unusual ocean current, with water that is remarkably cold for its latitude. In 1803, a Prussian baron, Friedrich von Humboldt, dipped a thermometer into this current and recorded its unusually low temperature, and this oceanic river has since been called the Humboldt Current. But Humboldt was not the discoverer of the current, nor was he the first to observe how cold its water was. Oceanographers and geographers prefer to call it the Peru Coastal Current, or even the Peru Current.

The temperature of the Peru Current, however, is not its only interesting feature. Perhaps no other body of water in the world has such an abundance of fish life, which in turn attracts fantastic numbers of oceanic birds. Cormorants, or guanays, pelicans, boobies, gulls, terns, frigate birds, and Mother Carey's chickens dine gluttonously and practically interminably on this fare, particularly on the anchovies that make up a large proportion of the fish population in this area. The islands off Peru are dense, black masses of birds at the end of the day's fishing foray, when the "fishermen" seek their roosts.

This protracted feasting on fishes results in the production each year of many thousands of tons of the richest fertilizer on earth—the highly prized guano, vital to Peru's economy.

Why are there so many fishes in the Peru Current? And why is its water so cold?

The answer begins with the wind from the south and the southeast sweeping the surface water away from the shore. Cooler water from the bottom of the ocean then rises to replace the warm water driven off from the top. And as the bottom water rises, it also brings to the surface nitrogen and phosphorus compounds that originated from the remains of animals and plants that settled to the bottom.

It is this nutrient material that supplies the basic first step in the elaborate food chain of the Peru Current. Diatoms, the microscopic algae making up the bulk of the plant plankton in these waters, utilize these nutrients as well as photosynthesis to manufacture their food. The result is that they tinge the water green with their numbers because of the abundance of raw materials.

Here is where the anchovies enter the picture. Primarily plankton-feeders, they feast voraciously on the diatoms, as well as on the other plankton that happens to be around. The result is that they, too, populate the waters in great numbers.

Next come the larger fishes that find anchovies dainties beyond compare. And

The members of the Yale-South American oceanographic expedition were, clockwise around the globe, Edward C. Migdaeski, James E. Morrow, Jr., Sarah B. Wheatland, Gerald S. Posner, and Daniel Merriman, director.

YALE UNIVERSITY NEWS BUREAU

their consumption of tremendous quantities of anchovies brings their own numbers to astronomic proportions.

Finally, the oceanic birds devour both the anchovies and the larger fishes, with the result that the abundance of bird life in this area is one of the most remarkable biological phenomena on the face of the earth. For a classic description of the amazing concentration of birds, the reader is referred to the monumental treatise by Dr. Robert Cushman Murphy, *Oceanic Birds of South America*.

But the food cycle does not end with the birds eating the fishes. The birds now excrete enormous quantities of nitrogen-and-phosphorus-rich guano. And man uses this fertilizer to restore nitrogen and phosphorus to his impoverished soil, in order to raise crops to feed himself and his livestock. Thus, the elaborate cycle, starting with a wind from the south along the coast of South America, is completed—and continually renewed.

BINGHAM OCEANOGRAPHIC LABORATORY, YALE UNIVERSITY

The *Marise*, originally a New England dragger, was converted into a scientific vessel for the Yale-South American expedition.

BINGHAM OCEANOGRAPHIC LABORATORY

→ Dr. Posner watches the return of a Clarke-Bumpus plankton sampler after a 15-minute tow in northern Peruvian coastal waters.

The vertical transport of water to the surface is known as upwelling. It is estimated that upwelling alone brings about 400,000 metric tons of phosphorus to the surface of the Peru Current each year. The annual deposit of the end product, guano, reaches the sizable figure of 150,000 dry metric tons annually. For the production of so much fertilizer, states Dr. Gerald S. Posner, an oceanographer who recently investigated the area, "it is estimated that the yearly consumption of fish by guano birds about equals the total annual commercial fisheries catch for the entire United States."

But, periodically, something happens to upset the delicately adjusted food cycle of the Peru Current—and sometimes with disastrous results. The culprit is the phenomenon called El Niño, or The Child.

Every year, soon after Christmas, a warm current of water of low salinity moves south along the shore of southern Ecuador and northern Peru. Because it appears so soon after the religious holiday, the natives have for hundreds of years identified this current with the Christ Child, calling it El Niño. The earliest reference in print to El Niño was in 1608, when a Jesuit priest wrote that the winds coming from the north were "troublesome and unwholesome."

This phenomenon generally lasts until the end of March, and then El Niño disappears. The water again becomes cold and more saline.

Ordinarily the coastal area of Peru has an almost oppressively dry climate, but when El Niño makes its visit, it is accompanied by rain—often in destructive torrents. El Niño probably originates in the tropical waters of the Equatorial Countercurrent and the region off Central America. Dr. Posner thinks that it is transported southward by winds produced by various changes in atmospheric circulation in both the eastern and western Pacific.

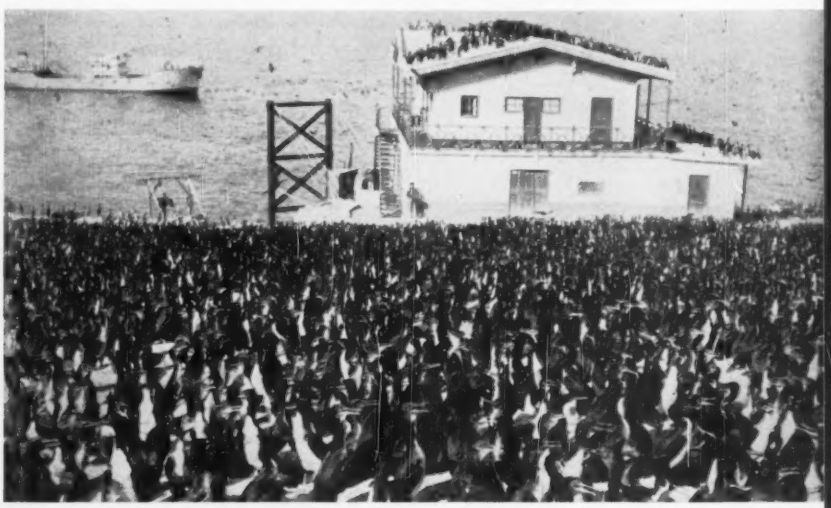
For roughly six years out of every seven, El Niño does not produce undue mischief, other than winds and rain. But about every seventh year it gets out of hand with a vengeance. Then it progresses deeper down the coast, accompanied by rains that wreak havoc. The effect on the food cycle, from plankton to man, has often been catastrophic.

Through the ages, the fishes and the organisms on which they feed in the Peru Current have become adjusted to living in cold water of high salinity. When the warm El Niño current, low in salts, penetrates deeply into this normally cold area, the animal plankton die off. The fishes either flee or die in tremendous numbers, their bodies piling up by the millions along the shore.

And now the birds, too, are affected. Starvation sets in. Nests are deserted and the young left to perish, while the adults fly off to places where food can be found. Those that remain soon become exhausted by their fruitless quest for food. Weakened by hunger, they fall prey to disease, and their carcasses soon litter the coastal areas and islands in windrows.

It is at this crucial point that the Peruvians feel the economic pinch of the massacre of the birds. The heavy torrents have already washed thousands of tons of precious guano into the sea. But now these losses are increased by the death or disappearance of the guano-producers.

The natives of Peru, going back to ancient times, have literally geared their lives to guano, which is 150 feet deep in some places. The guano birds have always been protected, and many large fortunes originated from guano deposits. Were it not for guano, Peru, with its arid soil, would long ago have become an impoverished country.



A close-up photograph shows some of the vast number of guano birds that live off the coast of Peru.

← The eggs of the guano birds are laid in shallow nests on the ground, among small mounds of guano.

Many investigators have reported the often unusual phenomena that accompany a full-fledged El Niño. One of the most thoroughly documented and vivid accounts on record is that of Dr. Robert Cushman Murphy, who made on-the-spot observations during the catastrophic El Niño invasion of 1925. This is what happened:

Rains swelled into torrents which destroyed roads, railways, bridges and homes. On one day alone an estimated 95,000 metric tons of water fell on one city. Lima and Callao were without light and power because of the destruction of the hydroelectric stations. Transportation was completely disrupted. Lush, tropical vegetation appeared practically overnight, with an abundance of insects to feed on the unwonted greenery.

In previous visitations of El Niño, the waters have taken on unusual colors, often becoming blood-red. The white paint on houses near the shore and ships in port have turned black. The natives call this phenomenon "El Pintor," or The Painter. And because ships in the harbor of Callao have been notoriously subject to blackening, it is also known as The Callao Painter.

All this happens because the warm water of El Niño encourages the production of tremendous numbers of tiny, red organisms, called dinoflagellates, which impart their color to the water. These dinoflagellates produce a poison that kills the fishes. And the decaying fishes release hydrogen sulphide gas that combines with the lead in the paint on houses and ships to form a black pigment.

A similar phenomenon, called Red Tide, has in recent years caused widespread destruction of fishes in Florida waters on the Gulf of Mexico side.

In the middle of March and early April of 1953, El Niño made its most recent major visit to the Peruvian coast. Compared to what happened in 1925, with its heavy toll of fish and bird life, the visit was mild.

Luckily for science, the Bingham Oceanographic Laboratory of Yale University had an expedition in Peruvian waters between March 10 and May 21 that year. Oceanographers (among whom was Dr. Posner) and fisheries scientists were thus able to make a number of scientific observations of this phenomenon from their ship, the *Marise*, a 63-foot New England commercial fishing vessel converted for oceanographic survey duty.

The Yale scientists sampled the water in various ways. An instrument known as a bathythermograph was lowered to various depths, and the temperature was registered on a glass slide. Samples of water from various depths were collected in special bottles for later chemical

analysis. Plankton was collected in fine-meshed nets, and the transparency of the water was measured. Fishes of various kinds were collected, including some species new to science.

An interesting fact discovered about El Niño during this expedition was that the southward-flowing warm water, which covers several thousands of square miles, is a thin layer of less than 100 feet.

One of the most fascinating problems of El Niño has been its "crash" appearances about every seven years. Dr. Posner made analyses of air pressure data going back for an extensive period to see if cyclical meteorological changes would account for this seeming regularity. He found no evidence of true cycles, and he believes that fluctuations would better describe the periodic visits.

Many questions about El Niño still are unanswered. But the Yale Expedition has now made available a wealth of important new data which will be studied by oceanographers and fisheries scientists for many years to come. The increasing importance of the sea as a source of food is now generally recognized; and a complete understanding of upwelling and the food cycle of the sea will contribute to our making full use of this vast reservoir of potential food supply.

The Yale Expedition has made a major contribution toward achieving this goal.

Note: The author acknowledges with gratitude the generous assistance of Professor Daniel Merriman, Director of the Bingham Oceanographic Laboratory of Yale University, in the preparation of this article. His making available previously unpublished material is particularly appreciated.

Prunella, the Globe-trotter

By
PAUL MASON TILDEN

Photograph by the Author

The common little wildflower self-heal, or heal-all, is sometimes found with blossoms that are pure white, like this specimen from Richmond Furnace, Pennsylvania.

WHEREVER THERE is a measure of shade and a modest supply of moisture, you are likely to find little Prunella pushing her flower heads up for the attention of the bumblebee. Prunella is a widely traveled lady of the plant world who went into Linnaean times being called *Brunella* and somehow came out bearing the generic name of *Prunella*, with the specific title of *vulgaris*, the common. Most folks know the small perennial as self-heal, or heal-all, names that reflect the thought of former times that its leaves provided a remedy for the ailment known as quinsy.

Few indeed are the plants that are distributed as widely as heal-all. It is as much at home in Europe and Asia as it is America, and all summer long the spikes of light-to-dark-purple flowers, blooming progressively and helter-skelter upwards from the base of the flower head, lend a touch of modest color to our back yards, country road borders, and half-shaded woods-margins. Here and there you may find a colony of gayer-colored plants with rose-pink blossoms, and, if fortune smiles brightly, a plant with pure white flowers.

This friendly little growth has never achieved any success with the gardeners, although several close relatives have been used in European flower gardens. Its specific name suggests the reason why the plant has been ignored by horticulturalists—the rose-pink and the purple varieties are too common to attract attention. And, in addition to that, the individual flowers are so small that it takes a pocket magnifying glass to bring out their simple beauty.

When blossom-time is nearly finished, *Prunella* sends up a low whorl of glossy, deep green leaves from the base of the stalk, leaves so different from those of the year that it takes a second glance to be certain that they are coming from the same plant. Then the tiny brown seeds drop from the brown flower head, and *Prunella*, the globe-trotter, is ready for winter and an early start the following spring.

"A lake, a dark onyx mirror picturing the sunset's ember glow, spread glass-like before me."

Margins of the Marsh

By JOHN LINDSEY BLACKFORD

Photographs by the Author unless otherwise credited

GEORGE M. BRADT

A shadowy phantom was the first intimation of that lurking night hunter, the horned owl.

STEALTHILY slipping my paddle from the brown, root-stained lake water, I drew it inboard and let the light breeze drift the boat toward the rippling cattail-tule wall. Wind-borne, the sleek square-stern canoe soon lodged against thin, fringing reeds. There it idled, pivoted, pressed them down, and swung gently into a little cattail cove, barely a paddle's toss from one of the most retiring mysteries of the marsh, a bog-loving bittern.

Why that big, striped spearman, so adept at sly concealment amid the sword-leaved mazes of Montana's Island Lake Marsh, still stood boldly in the watery open on the end of a sunken log was evident as the craft came gliding down to the lush green cattail coast. Almost at once, from up-lake, my field glasses had revealed the wily marsh hen preying on the swiftest aeronauts of the swamp. And for the first time the elusive "thunder-pumper" proved indifferent to near approach. Wafted in on light swells, I had time to size up the surprising situation.

A drowned "deadhead" lay water-logged in the bottom mire, parallel to the lakeside margin of the marsh. Only a narrow fringe of broad-bladed cattails and giant bulrush divided it from the woodland lake waters. Along this outer bur reed, cattail, and tule screen, sapphire dragonflies darted in aerial patrols. At the end of the beat, where the marsh wall curved to the rising lakeshore and the wading cattails thinned, the big blue "bombers" turned in jewel-winged flight. Threading the waving reed-tips for but an instant, they banked and shot, jet-like, back through the long narrow alleyway that marked the grave of the sunken log. At the end of

this straight, green channel in the cattail tangle, the mosquito hawks rocketed out with bullet speed into the convenient cove. Then, through its reed-fringed portal, where the boat rode lightly rocking against wind-lifted lily pads, they won to open lake and their accustomed course along the towering tule wall.

It was at the most strategic point in the long round of their patrol flights that the bittern had stationed himself—the shallow underwater end of the sunken log. There, at the termination of the green cattail alley, where the darting blue darners came speeding down the leaf-lined aisle, and just across the cove inlet from me, the bog-land heron was absorbed in spearing those streaking blue bullets from the sun-filled morning air. Only such a prospering occupation had overcome his canny cautiousness.

As I stared, fascinated, this master of the slow-motion step, the quaking sedge-mat, and the false-bottomed ooze, struck with lightening thrust. In succession he took four winged blue-streaks as they came glinting through. The "Indian hen" missed a fifth dragon, but caught a sixth cruising off-course above the tules. A watchful pause—then he fell off the log-end trying for another jeweled aeronaut; yet, on regaining his vantage point, successfully speared the circling insect. I would have been happier to see less accurate marksmanship. Those double-winged mosquito-murderers are favorites of mine!

There came an understandable slackening in the dragonfly flight. With snaky step, the bittern left his station and slid through the rank cattail blades to impale unseen prey. He returned to interrupt another blue bullet with rapier strike. The glassy, net-veined "propellors" of the blur-winged bombers were gulped down unceremoniously along with their brilliant hulls. Sometimes the rasping wing-edges required an extra, awkward swallow. After taking each blue darner aboard, the marsh wader helped himself to a drink. At length, timed by my slight move, the "stake-driver"—author of the most legendary sound of the bog—sprang into the air with a gulping squawk. In ungainly flight, the bittern departed for far green margins of the marsh curving around the distant shore. I had seen one of the cleverest feats of secretive swamp dwellers—the capture of the jet-swift dragonflies—so close that binoculars were only in the way!

At remote Loon Lake, one evening, there unfolded some of my most revealing moments with beaver. In a small, sheltered bay, where pond lily-pads patterned dark, quiet water, successive slight ripples drew attention to two emergent furry heads, far out from the sedge-grown shore. From the forested slope above, my glasses peered intently, curious to learn why the flat-tails idled at the surface in deep water. But fast-flipped pads, held in clever forepaws, showed that the beaver were stuffing themselves with a succulent salad; green, floating, heart leaves of the yellow pond lilies.

It was not a brief nip before hauling up into the alders for usual bark-stripping. Other heads silently broke the mirror surface. Soon seven big-toothed wood-cutters gathered in the shadowy aquatic garden of the little bay. They spent an entire hour of late summer twilight feasting on the juicy leaf-pads of *Nymphaea!* As nearer ones fed the pads into busy mouths, it sounded as though they were munching cabbage.

Evening's dusky hours often capture for us little secrets of the wild that in its dim, alluring setting become memorable far beyond their momentary significance. Several nights had passed at a reed-rimmed lakelet in Pleasant Valley; yet without explanation of what brought the series of watery splashes along the camp-side shore at early dark. Then, when light yet lingered along the narrow marge, I heard again the approaching splash and plunge of some boisterous swimmer, so loud as to advertise a playful mink or otter.

In the western sky lingered the fading, smoky-rose of dying afterglow, while under a pale canopy of gray and vanishing azure, only the lake revealed its far-flung shore.

But the solution of the little marshland mystery proved peculiarly satisfying, if not so spectacular. Slipping from my sleeping bag, crawling with extra caution to the bank above, I discerned with help of the night glasses, the streamlined form of a lone waterfowl. Nearer the duck came, confidently close along the shore in waters she now shunned during daylight hours. It was a wood duck hen, paddling quietly; yet leaping clear at intervals to pull down full seed-heads of tall margin grasses bending along the pond's edge. As I studied her, she fell back repeatedly with watery splash and spatter, to dabble luxuriously in the warm night, feeding upon each fattened seed-tassel won by her nocturnal labors. Such secrets of the marshland dusk recall an early canoe trip to our lake country in northern Montana.

Great spruces closed about the winding channel of black water that curved away mysteriously ahead of my exploring canoe. Guardedly the paddle dipped in the darkly placid stream. Its following eddies coiled in swirling circles back past the stern, to mingle with the gurgling wake of the adventuring craft. At a bend, where silvery water grasses waved toward the glassy surface, a swimming beaver broke the reflections with a widening wedge of black ripples. In the sun's last, slanting rays shining down the deep evergreen canyon, I caught the iridescent sheen that glanced from the glossy back of a three-toed woodpecker. This, I sensed in the gathering dusk, was the Primitive, the Wilderness Forest.

On through deeper recesses of the primal wood I urged the canoe. Spired spruces, converging so closely, seemed ever about to halt us now. Then abruptly the forest receded. A lush mountain meadow lay revealed. Between tall, bordering cattails, the boat glided on sluggish waters draining a broad divide. Soon a lake, a dark onyx mirror picturing the sunset's ember glow, spread glass-like before me. Its curving embrace circled beyond the dark-mantled hills. Here was beauty and peace in such full measure as to bring heartache.

Tall tules waded distantly out over the shallows. Beyond, where I paddled into a beckoning cove, pond lilies bordered the sedges, their wide, scalloped, leaf-pad margin trimming the marshland coast.

Already dusk had captured the encroaching forest. In the western sky lingered the fading, smoky-rose of dying afterglow, while under a pale canopy of gray and vanishing azure only the lake revealed its far-flung shore.

Now I stalked a strange, chill cry that came intermittently from the farthest reach of the mysterious cove. Beyond, nothing stirred in the timber. Yet, in piercing reiteration, that petulant hunger-cry seemed almost to sever the gathering gloom. Night bird, will-o-the-wisp, or furry prowler? The canoe crept into a channel dividing islands of the lily-pad zone.

Along the outer bur reed, cattail and tule screen, sapphire dragonflies darted in aerial patrols.

No wings beat above the slough grasses. No claws clutched at scaly trunk in the forest. The silent craft edged in to the rank, floating mat of the crowding sedges, then drifted on to a break in the tall, screening cattail wall. Senses strained to pinpoint that insistent, querulous complaining.

With binoculars illuminating a magic circle in the shadowy last-light, I searched the wilderness inlet. At length, beyond the wide girth of the sedge belt, the scattering swamp shrubs, over bordering bog willows, close against the great bole of a towering tamarack, huddled a fledgling owl, protesting his early night-hunger. Above that moss-draped perch drooped wide spreading larch boughs. And from this gnome-like seclusion, it was his urging, admonitive cry that assailed the gathering darkness.

Uncertain as to whether the day's adventure had ended, I rested my paddle across the gunwale. Presently, where tangled cattail roots supported a small, dank platform of decaying swamp growth, a sleek head divided the oil-like surface. A muskrat emerged. Before him a short, steep runway climbed into the succulent sedges. The water rat raised himself on taut haunches, braced by long, snaky tail-rudder. In the intentness of listening, he seemed to reach forward as though grasping at some whisper of danger in the uncertain dusk. Only a canoe-length away, with glasses magnifying the faint light, I could observe his sleek, damp pelage; even his long sensitive whiskers, barely twitching, as he tested the scents of the night marshes. Two reluctant minutes he froze in silence—three—then hastily slid into the water.

A tule's length along the reeds the muskrat suddenly split the ripples of his inshore course by swiftly diving. From low over the broad-bladed slough grass a gray wraith swept by on shadowy pinions, a menacing phantom. It was my first intimation of that lurking night

Along the marshy margin, a wood duck paddled quietly.

hunter. The young horned owl in the tamarack dark maintained his petulant wailing.

The last dulled silver of day vanished with the early rising of a blood-orange August moon, first told by a streamer of luminous cloud shining above the eastern hillcrests; then by shrill yip-yapping of coyotes in canyoned hills still flooded by purple gloom.

This night had given the answer of the stream's source. This cruise revealed what beckoned beyond in the depths of the forest. Turning from the marshy margin while a stir of wind shimmered the lake, I sent the canoe leaping toward the outlet, speeding downstream through the black corridor of the spruces.

America's Favorite Tree

By RUTH H. DUDLEY

Photograph by courtesy of Michigan Tourist Council

CERTAINLY the apple tree has played an important part in the beauty and prosperity of our country. In appreciation, both Michigan and Arkansas have made the apple blossom their State flower, and the apple tree, of no particular species, is listed as the unofficial State tree of both Michigan and Iowa.

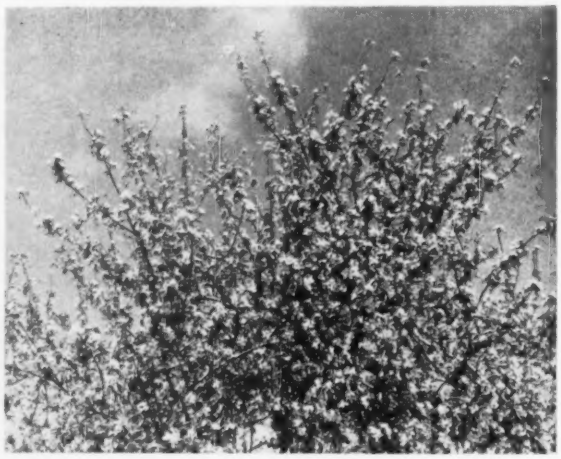
"As American as apple pie," the saying goes. Yet the tree from which this fruit comes is not American. All the cultivated apple-bearing trees in our orchards came originally from other lands. Our own native crab-apple tree cannot be tamed or cultivated, although wild crab-apple trees from other lands can be.

Scientists think the ancestors of our cultivated apple trees first grew many centuries ago around the Black and Caspian seas. Many thousands of years ago, peoples of Asia and Europe learned to cultivate and raise delicious apples from these primitive wild trees.

When the Pilgrims landed they found plenty of wild crab-apple trees already growing here. But their fruit was small and sour—not at all like the sweet, cultivated apples they had been used to. Later settlers brought apple trees with them, and these grew and thrived.

Our native crab-apple is small and shrubby, growing to about thirty feet, and some species of it grows in almost every part of the country. The wild crab-apple blooms in late spring, and the beauty and fragrance of its blossoms are a colorful spring event. The Iowa crab is the pride of the prairies; it blooms earlier, along with the orchard apple, and its pink-white blossoms have an unmatched fragrance.

The Oregon crab-apple grows along the Coast Ranges



The trees that give us the fruit for our apple pies and sweet cider are not native to America.

from northern California to Alaska, and early settlers made a delicious tart jelly from the apples. Many planted wild trees in their yards just for the pleasure of the sweet bloom.

The apple easily reverts to its original wild state, and is not grown successfully from seed, although sometimes seeds dropped by wild trees develop into valuable new strains. The Baldwin and McIntosh are perhaps the most widely known of these.

This bristlecone pine is now believed to be the world's oldest living thing. For 46 centuries it has been growing in what is now the Inyo National Forest of Southern California's White Mountains, and was dated by the late Edmund Schulman, at left in photograph, and his assistant, M. E. Cooley, at right.

PHOTOGRAPH COPYRIGHTED BY THE NATIONAL GEOGRAPHIC SOCIETY

Marvels Among Trees

By HENRY CLEPPER

LAST MARCH, the *National Geographic Society* announced the discovery of a living tree 4600 years old—possibly the oldest living thing on earth. The tree was a bristlecone pine, located in the arid White Mountains of southern California, near the Nevada line, and its age was determined by the late Edmund Schulman, a specialist in the science of dendrochronology, or tree-dating. Dr. Schulman had been the director of the Laboratory of Tree-Ring Research at the University of Arizona.

The giant sequoias, so long believed by foresters and botanists to be the oldest living species, now take second place in longevity to the bristlecone pine. Of course, the world renowned sequoias of California, attaining ages of 4000 years, are still among the Methuselahs of plant life.

In the Cache National Forest of northern Utah, in Logan Canyon, there is a remarkable specimen of Rocky Mountain juniper. First reported more than thirty years ago, it has been examined frequently by United States Forest Service officers and scientists at Utah State University. Although only forty-five feet in height, its trunk is twenty-six feet in circumference, and its estimated age is from 3200 to 3500 years.

It is of more than casual interest that both the tallest tree in the world and the tree with the largest girth are to be found in North America. The tallest is a California coast redwood, 364 feet high, growing in Humbolt County, while the tree with the greatest diameter is a Montezuma bald cypress, in the Valley of Oaxaca, 340 miles south of Mexico City. It is 36 feet in diameter, although only 130 feet tall, and is known as the "big tree of Tule" for its location in the Village of Santa Marie del Tule. The bald cypress is the national tree of Mexico.

The late Bob Marshall was a forester who wrote several books based on his expeditions into the arctic regions of Alaska to study tree growth at timberline. High up on the slopes of Mt. Doonerak he made one of his most interesting finds—a windswept black spruce six and one-half feet high, three inches in diameter, and 346 years old. In a friendlier habitat as, for example, Ontario or Minnesota, the black spruce may attain a height of eighty feet and a diameter of three feet, although it is commonly much smaller. But in that unfriendly Alaskan environment, it had to fight desperately to survive at all.

The tenacity of a tree for life, and its incredible ability to survive under hostile conditions, is illustrated by the whitebark pine of the western United States and Canada. Although a tree of the high mountains, the whitebark

PHOTOGRAPH BY REX KING, U.S. FOREST SERVICE

In favorable situations, the Engelmann spruce is a handsome and long-lived tree that may attain a height of 165 feet. Under the severe conditions at timberline, however, the same species, although of great age, may be no more than a prostrate shrub, as shown in the above photograph taken at a high elevation in the Carson National Forest of New Mexico.

Although only forty-five feet in height, the Rocky Mountain juniper pictured below is estimated to be between 3200 and 3500 years old. This tree is in Logan Canyon of Utah's Cache National Forest.

PHOTOGRAPH BY J. O. STEWART, U.S. FOREST SERVICE

pine is capable of thriving on lower elevations where, on good soils and in protected sites, it becomes tall and symmetrical. But on the summits of towering ridges, where it clings buffeted by perpetual winds, the tree has branches only on the leeward side. In such locations it adapts itself to winter temperatures of 60° below zero, and to brief summers so frosty that they are summer in name only. Stunted, deformed, grotesque, it is almost a caricature of a tree; but it is alive!

A number of other species have such an adaptability to inhospitable environment. Mountain climbers and explorers of the northern timberline frequently encounter trees that, in more suitable locations, are perfectly normal, but which in such harsh and bitter habitats become hardly more than dwarf ground cover. This condition is often encountered in areas of permafrost, or permanently frozen ground. Strange as it may seem, permanently frozen ground may support an abundance of vegetation, the result of a combination of low temperature with low precipitation.

Not all tree species become stunted when transplanted in an alien land. The Monterey pine of California, although a handsome ornamental tree of medium height, is commercially unimportant within its limited American range. But in Australia and New Zealand, where it has been planted extensively for nearly fifty years, this pine is the most important source of softwood lumber. A fast grower, it produces saw-logs in from twenty-five to thirty years. Nearly a quarter-million acres have been planted to Monterey pine in those two countries.

In the study of trees, one may encounter many strange phenomena. It is not uncommon to find extremely tall redwood trees, Douglas firs, and Sitka spruces, for it is the nature of these trees to be tall. But to encounter

The Grand Tule Tree, in the village of Santa Maria del Tule, Oaxaca, Mexico, is reputed to have the largest diameter—36 feet—of any tree in the world. This is a Montezuma bald cypress, representative of a species that has often been known as the national tree of Mexico, and is called *ahuehuete*, or "never aging tree," by the Mexican Indians.

PHOTOGRAPH BY F. P. CRONEMILLER

examples of gigantism in trees that are naturally stunted, or shrub-like, is so exceptional as to be botanically noteworthy.

Two interesting cases are provided by species of so-called scrub oaks. The scrub oak of the eastern States, also known as bear oak and ground oak, usually grows in dense thickets on rocky hills. It rarely exceeds fifteen feet in height, yet the American Forestry Association has a record of one in Center County, Pennsylvania, that measured thirty-six feet tall. Its western cousin, the California scrub oak, seldom averages more than eight feet in height. About thirty years ago, a well-known dendrologist wrote, "This tree never becomes large." But Woodbridge Metcalf, veteran University of California extension forester, subsequently measured a specimen in San Luis Obispo County that was ninety-five feet tall!

Trees, in common with all living things, succumb to the infirmities of age, and die—if they are not killed by fire, insects, or disease, uprooted by wind, or felled by the logger. Man, with his three-score years and ten, may seem short lived in comparison with the sugar maple or the hemlock, which may live to the age of 500 years, the bald cypress and oak that may attain 1000 years, the juniper that may reach 2000, the giant sequoias that may attain 4000, and the bristlecone pine of 4600 years. Yet, on the other hand, the span of man may be double that of some tree species. The gray birch, the large-tooth aspen, some willows, and several other species have life spans shorter than man's.

Approximately ten percent of the woody body of a tree is in the root system, and roots require air, food, and water for growth. In turn, they supply mineral nutrients that are carried in a stream of water to the top of the tree. And, of course, they perform another service, too; they anchor the tree to the ground, and keep it upright. The length of the complete root system of Longfellow's spreading chestnut tree, under which the village smithy used to stand, doubtless totalled hundreds of miles.

The physiology of tree growth is interesting and complicated. Through the phenomenon known as photosynthesis, aided by nitrogen and mineral elements, a tree develops a body of wood. In a giant sequoia, up to 50,000 cubic feet of woody material may be formed. Although no practical method has ever been devised for actually weighing such a tremendous tree, its weight may be estimated. If a cubic foot of the wood weighs thirty pounds, the total mass would tip the scales—provided such scales existed—at 1,500,000 pounds, or 750 tons!

Let us now make a comparison between such a large tree and the largest animal. The blue whale is believed to be the largest animal that ever lived; and whalers have reported specimens more than 100 feet long. The average weight of these monsters is probably about 75 tons. Hence, the biggest tree has nearly ten times the weight of the largest animal.

We have seen that the world's tallest tree is a coast redwood in California, actually measured as being 364 feet high. If its deepest root could be added, the total length would certainly exceed 400 feet. Thus, the total length of the tallest tree is four times that of the biggest animal!

LITTLE NERO

Autumn's warning burns the grasses,
A cricket fiddles while summer passes.

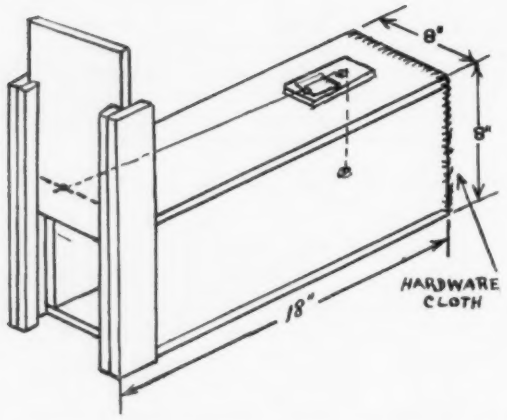
Donnafred Baker Hoff

How one man solved the

Bird Feeders' Squirrel Problem

By FRANK BEQUAERT

Illustration by the Author



A box trap of the above construction helped the author deal with the squirrel problem at his bird feeding station. Trapped squirrels are released in woods several miles from site of feeding station.

IF YOU ARE plagued, as we were, by squirrels monopolizing your bird feeding station, you may find our solution to this problem of interest. Rather than using an unsightly "squirrel-proof" feeding station, or resorting to poison or harmful traps, we cut down the number of squirrels raiding our station by trapping them alive and releasing them in the woods several miles away.

We used an extremely simple box trap to catch the squirrels. The illustration shows the method of constructing such a trap, the measurements being approximate for the trap built by the author. Materials needed were: a mouse trap, a small piece of hardware cloth, and two one-foot lengths of baling wire. The body of the trap may be made from a small wooden box, or built from scrap lumber. The trap body should be oblong and open at both ends.

Cover one open end with hardware cloth. Do not use window screening, as squirrels can chew through it in a matter of minutes. Construct the door slide at the other end of the trap, as shown. Make the door to fit the slide loosely. A small trap-opening will keep out stray dogs and cats.

Nail an ordinary spring mouse trap to the top of the trap as shown, and directly beneath the trigger of the mouse trap drill a small hole into the interior of the trap. Run a piece of wire through this hole, attach one end to the mouse trap trigger, and form a loop in the other end to hold the bait.

Drill a hole through the trap door in such a way that when a wire is inserted in this hole it will rest against the top of the body of the trap, holding the door open. Attach a wire to the end of the snap spring of the mouse trap, and run this wire to the hole in the trap door. The wire should be cut so that it extends just through the hole when the mouse trap is set.

The trap may be baited with a variety of squirrel delicacies. We found that bread and peanut butter, or suet and peanut butter worked equally well. The bait should be wrapped tightly in the wire extending down from the mouse trap trigger. A few pieces scattered on the ground in front of the trap will induce the squirrel to enter.

To set the trap, hold the mouse trap in the "set" position, lift the trap door, and insert the wire from the mouse trap in the hole in the door. Then set the mouse trap. A squirrel pulling on the bait inside the trap will release the mouse trap. The mouse trap, closing, yanks the wire out of the hole in the door, and drops the door behind the squirrel.

Once a squirrel is caught, it may be kept in the trap until released or transferred to a cage. However, do *not* attempt to handle wild squirrels with your bare hands, as the animals are extremely active and their teeth are sharp. Even gloves guarantee no protection.

We placed the trap on the ground beneath the tree where our feeding station was mounted. The best time for trapping, we found, was in the morning. Squirrels showed no fear of the trap, and entered it without hesitation. Birds, on the other hand, would not go near it, except for one adventuresome wren who trapped herself but who was released unharmed.

From a humane standpoint, squirrels may be trapped at any time during the year except during the breeding seasons. Local wildlife agencies can give you the best information about the breeding season or seasons in your area. The local squirrel-hunting season is always a good time to trap.

It is difficult to estimate the number of squirrels in an area that are visiting a bird feeding station. What, to all appearances, is one pair of squirrels may in actuality be a number of pairs visiting the station in shifts. We discovered that it was necessary to trap about a dozen squirrels before the station became relatively free from them. It also may be necessary to repeat the trappings every few months as new squirrels migrate into the feeding station area.

The Last Weeds of Summer

By E. LAURENCE PALMER

This is the ninety-eighth of NATURE MAGAZINE'S *special educational inserts*

Illustrated by Betty Burckmyer

DANA BURNET is an artist who has effectively used the keys of his typewriter and piano to paint the pictures in his mind. For years he supplied the popular weekly and monthly magazines with tried-and-true stories of the rich boy who married the poor girl, or vice versa. But to him and to at least one of his heroes or heroines his greatest claim to lasting fame will rest with a verse, little of which is generally known. Even in writing a soliloquy of a man "In a Death House" he finds something solid to which to cling, when he tells us:

"But light and song are freedom's wear.
And even death-doomed men
However they may lock their brains
Fall dreaming now and then,
And see the white topped daisy-fields
Go marching up a glen."

It is of these daisy fields, and of other weeds of the late summer season—and even of early winter—that we now write. It is rather distressing to find that, as with buttercups, *The Bible* makes no reference whatever to any of the eighteen weeds we have selected to represent late summer and fall. It happens, however, that of the eighteen, only chicory and oxeye daisy are both conspicuous plants and native to the eastern Mediterranean area, where *The Bible* had its setting. Too, many of the poets who have written of daisies were not botanists, and have used the word with generous poetic license. Shelley, Burns, Wordsworth, Milton and Shakespeare make only incidental reference to the plants we choose to recognize here, and not one seems to have been at all discriminatory in comments made.

Concerning our fall flowers, we find Henry Ward Beecher, in his "Discourse of Flowers," giving us in prose something of the philosophy we had in mind. He says, "As for. . .valorous sunflowers, we shall never have a garden without them, both for their own sakes and for the sake of old fashioned folk who used to love them." Again, he speaks of "broad-faced sunflowers." Wordsworth recognizes the almost universal reference of poets to daisies by calling the daisy "the poet's darling," and begins to do a little better than the average with such an ecological observation as:

"The daisy by the shadow that it casts,
Protects the lingering dew-drop from the sun."

And Shelley goes a bit "high-brow" when he tells us:

"Daisies, those pearled Arcturi of the earth,
The constellated flower that never sets."

Burns is a little more commonplace, as you would expect, and gives us:

"Now Nature hangs her mantle green
On every blooming tree
And spreads her sheets of daisies white
Outowre the grassy lea."

What would Burns do without a "grassy lea?"

Some years ago, I wrote a number of articles dealing with the silhouettes of weed shadows along a sidewalk, and was delighted to find that Wordsworth, while he was not interested in species identification through shadows, found beauty in these things. He wrote:

"Would that the flowers were born to live
Conscious of half the pleasure which they give,
That to this mountain daisy's self were known
The beauty of its star shaped shadow thrown
On the smooth surface of this naked stone."

Horseweed

Wild Sunflower

False Sunflower

Elecampane

For a while, at least, let us ignore the impression these weeds may have made on writers of prose and poetry, and consider the evaluation given them by the farmer, the doctor and the botanist. My grandfather, a dirt farmer, in his incidental conversation taught me to recognize chicory, elecampane, tansy, black-eyed Susan and horseweed, of the eighteen weeds I have selected to represent the fall flowers.

I am sure that all of the weeds I have considered here are well known to farmers of the East and middle-West, and some of them are known to farmers of the far West; a few are known to farmers everywhere in the world. What interests me is that these homespun folk told me nothing of the nature of the plants, how they affected the grazing cattle on which their own prosperity depended, how they anchored the topsoil that they were losing with every shower, and, on occasion, how they even affected skins and noses when the weed dust was breathed, or rubbed on sweat-covered skin. These were trifles then, perhaps.

Blazing Star

Black-eyed Susan

In reading the accompanying tabular material, you may be impressed with the fact that most of these weeds are perennial, and that many have substantial horizontal root systems, ideal for anchoring the soil in the fencerows where the plants grow naturally. It is possible that, because of this stabilizing effect, many a farm has paid off its mortgage rather than going on the auction block. It should be noted, also, that most of these weeds yield readily to the simplest methods of weed control, and only the oxeye daisy vigorously resists strong applications of 2-4-D, and similar chemicals.

Of particular interest to farmers are the sections in our tabular material dealing with the coneflower, daisy, elecampane, gumweed, horseweed, sneezeweed, tansy and white snakeroot.

Many of these weeds have had a prominent place in the homely folklore dealing with our health that may well be yielding to the supersalesmen of television, who tell us what we should eat, drink, and smoke. In the tabular material, we have tried to suggest the diminishing public interest in many of the fall weeds formerly contributing to the medicine chests of many a farm. A few of these weeds may have lasting merit in this connection, but most of them persist more in the common names of the plants than they do in actual medical merit and practice.

Some of the names of plants that refer to a real or purported medical value are sneezeweed, gravel-root, scabroot, boneset and a few others. Of course, boneset never set any bones, but folklore has it that it produced a medicine that might be taken when a bone was being set. Possibly this is because it has such a vile taste that one would, temporarily at least, forget the anguish of bone-setting in the distress caused by the medicine.

Much of the medical lore about these plants persists in print long after the recognition of merit has been discarded. We have carefully tried to distinguish between the real and the rumored values.

Along with medical values, of course, come food values, and we have tried to present a fair picture of these, also. Few people recognize any food value in the

Cone Flower

Gumweed

Purple Coneflower

Sneezeweed

majority of the weeds considered here. Most of the pertinent food values are presented in the tabular material. Daisies and chicory may produce excellent potherbs or green salads. In Africa, the leaves of a close relative of our common bur marigold, or pitchforks, are cherished for this purpose by the natives. There seems to be little likelihood that our American species would satisfy an American appetite in this way. Chicory, of course, offers us a coffee substitute when its roots are collected, ground and roasted just after the period of flowering has passed. It also requires some faith and imagination to recognize the coffee flavor in chicory. One of the close relatives of the sunflower is the Jerusalem artichoke, whose underground tubers are really delicious to many. Moreover, they yield a non-fattening starch that some people would welcome into their diets.

When domestic mammals eat these plants as forage, startling things may happen, as a glance at the sections on sneezeweed, tansy and white snake-root will show. In the section dealing with daisies, we point to the practice of salting the rosettes of daisies to induce cattle to graze them so closely that they may not survive. Incidentally, too, the salting upsets the physiology of the plant so that it may die anyway. Where source material was available, we have passed on information relative to the resistance of these plants to weed sprays, their tendency to attract insects—the way golden glow attracts aphids, for example—and occasionally some other idiosyncracies of these weeds.

Botanists may note that all of the eighteen plants selected for presentation belong to the family Compositae. This was done because late fall seems to be a climax season for the composites, much as early spring gives emphasis to the maples, willows, poplars and oaks; late spring to the lilies and irises, and early summer to the buttercups, mustards, roses and legumes. The eighty-seventh insert dealt solely with the goldenrods and asters, and was therefore another composite monopoly, as well as another number dealing primarily with autumn weeds. It might be well to review this number of our series for some other aspects of this large family of flowering plants.

In answer to requests that have come in, we continue to include in the tabular material data on the chromosome number of many of the species, and some reference to the soil preferences of the plants. Some reference also has been made to the importance of such plants in supplying food for seed-eating birds in winter. In this service, the composites probably rank well with such families as the docks, the grasses, the amaranths, the mustards and the legumes. This information should appeal primarily to serious students of botany, and of ecology and wildlife management.

Our selections include most of the major groups of the composites that are based on the types of flowers to be found in the flower head. This information, too, is in our tables. These types include heads that are composed solely of flowers of the tubular type, with heads made of flowers that are all of the "ribbon," or strap-shaped type, and with heads that have (*Continued on page 480*)

Bur Marigold

Garden Sunflower

COMMON NAME SCIENTIFIC NAME	SWEET JOE-PYE-WEED *Eupatorium purpureum*	THOROUGHWORT BONESET *Eupatorium perfoliatum*	WHITE SNAKEROOT *Eupatorium rugosum*	BLAZING STAR *Liatris scariosa*
DESCRIPTION	Erect, to 10 feet high, rather coarse, with smooth or downy stem that is branched or unbranched, greenish or bluish, green- or purple-jointed, ridged or round in cross section. Leaves opposite or whorled, in 3s to 6s, long-petioled, to 1 foot long and 3 inches wide, smooth or downy, with saw-tooth margins, thin and vanilla-scented when broken.	Coarse, hairy stems to 5 feet high, branched above and pale green, rather brittle, ridged and erect. Leaves opposite and joined at base, so that they appear to be pierced by the stem, sometimes 3 at a joint, taper to elongate tip, prominently veined, saw-toothed margins, to 8 inches long and to 1½ inches wide, pale green like stems.	Grows to height of 4 feet or more. Stems smooth, to somewhat sticky, relatively slender, much branched at top, erect. Leaves opposite and in general outline much like those of associated nettles, to 6 inches long and to 3 inches wide, with petioles to 2½ inches long and slender, margins saw-toothed. Turn conspicuously black with first killing frost.	Height to 5 feet. Stem erect, usually unbranched, even in upper portions, arising from a solid base that is nearly spherical. Leaves alternate, rich green, rough or finely hairy, to 6 inches long and to ½-inch wide, entire and with the upper narrower than the lower, usually somewhat resinous in nature.
RANGE AND RELATIONSHIP	North American native of rich, dry, usually limey woods, or where soil is moist, from New Hampshire to Minnesota and south to Nebraska, Oklahoma, Tennessee and Florida. There are 500 species in the genus, mostly perennials and sometimes shrubby, tropical or subtropical. Some forms found in Eurasia.	North American origin. Often common in low swales, wet shores, woods, thickets and marsh borders. From Quebec to Florida and west to Manitoba, Texas; in south, in Alabama, and in northeast, in Nova Scotia. The bracts of the structure enclosing the heads of the members of this genus are unequal in length.	At best in rich woodlands and thickets or woodland borders. Ranges from the Gaspé Peninsula south through New Brunswick and New England to Georgia and Alabama, in the uplands, and west to southeastern Saskatchewan, northeastern Texas and northern Louisiana and on into Virginia. One of the conspicuous plants of woodlands in late summer within the range.	North American native. Genus with some 35 species native to eastern and central parts of the country, sometimes considered as in genus *Lacinaria* or *Laciniaria*. Typical of open country roadsides from Maine to Florida and west to the Rocky Mountains and into southern Canada. Found mostly in the drier soils.
REPRODUCTION	Flowers are all tubular, borne in somewhat cylindrical heads of 3-7 flowers, each with its pistil and stamens, and producing fruits to 1/5-inch long. Heads appear to be creamy white, pale pink, or pale blue or lilac. Flowers appear from mid-July to mid-September, with fruits often persisting until freezing. Chromosome number 20.	Flowers in heads, including 10-40 flowers that are white- to purple-tinged, with the heads crowded on stem branches to form flat-topped clusters. Some flower clusters come from stems that arise from bases of leaves that are not terminal. Corolla tubular. Fruit is 5-angled, black or brown, with yellowish dots and crowned with hairy parachutes.	Flowers in heads of 15-30 flowers, each to ¼-inch long, brilliant white, and maturing to bear fruits with white downy crowns so that a plant in flower or in fruit gives a conspicuous white effect. Each flower bears both pistils and stamens, or, rather, one pistil and 5 stamens. In distance, woodland with this in prime may appear to be smoky. 20 chromosomes.	Heads composed of 25-60 flowers, each with its pistil and stamens. Corollas are a brilliant magenta purple. Heads are hemispheric and are arranged along the stem but not too crowded. Heads enclosed in bracts in 5-6 series. Fruits are crowned by finely barbed bristles that form a parachute, which carries them with the wind.
ECOLOGY	Root yields a bitter, astringent, acrid substance used as home remedy for a diuretic, tonic and stimulant in treatment of "stones" in bladder or kidneys; hence common name of plant, "gravel-root." Root is to 1 inch thick, hard, tough and with thin gray bark. Medicinal quality which gave name kidney-root has not been recognized in modern medical lore.	Flowering season from July through September, with the fruits being shed in the winds into late fall or winter. Leaves contain the glucoside eupatorin, which has been used in medicine as a tonic or in large doses as an emetic. Plant is easily controlled by cultivation, drainage or hoeing.	Flowers from July through November, and leaves may remain green in woodland where other plants have dried and apparently died. Leaves and stems contain poisonous tremerol, which is soluble in milk fat. Cattle eating this may yield poisonous milk, causing milk sickness to both cattle and man. Cattle tremble, are depressed, constipated and nauseated.	Flowering time is from August through September and the plants are likely to dominate the countryside with their beauty during this period. The two most popular species are, in addition to this one, *L. elegans*, which has 9 chromosomes, and *L. pycnostachya*, either of which may be transplanted. Does not favor acid soils.
ECONOMY	As a weed this plant is not serious, as it yields readily to cutting, and frequent mowing is enough to control without use of sprays or plowing. The *"Weed Flora of Iowa"* states that this weed is useful in the treatment of jaundice, rheumatism, dropsy or gout, and that it is a diuretic. This may be questioned.	Dried leaves yield the fluid extract once recognized as important medicinally. Raised as a drug plant, one acre of ground should yield 1 ton of dry material once valued at 10 cents a pound. Its use now is most limited, and may be eliminated entirely in time. Such common names as boneset, agueweort may have some remote significance.	Milk sickness in man may cause weakness, vomiting, thirstiness, dry skin, constipation, slow breathing, low temperature, collapse and in some cases death. Cattle should not be allowed to graze in woodlands where white snakeroot is the dominant green food, for obvious reasons. Affected cattle may have difficulty in standing and in breathing or walking.	To some degree, these plants have a recognized use as ornamentals in flower gardens but hardly to the extent they deserve. The species here used is chosen not because of its exceptional beauty but because of its distribution, which gives it a wider audience. Common names include gay feather, blue feather, button snakeroot, rattlesnake master.

GUMWEED. TARWEED STICKY HEADS *Grindelia squarrosa*	HORSEWEED CANADA FLEABANE *Erigeron canadensis*	ELECAMPANE SCABROOT *Inula helenium*	FALSE SUNFLOWER OXEYE *Heliopsis helianthoides*	CONE FLOWER GOLDEN GLOW *Rudbeckia laciniata*
To 3 feet high, with stout, branched stems that are smooth and commonly with a reddish cast. Leaves strongly dotted, entire or finely toothed more or less clasping at the bases, alternate rough, to 1½-inch long and to ½-inch wide and with the lower usually narrowed at base but still clasping.	Height to 10 feet. Stem relatively slender, densely covered with stiffish hairs, or smooth, muchbranched with the uppermost branches turning conspicuously upward at their tips. Leaves alternate, the lower to 4 inches long, blunt, generally entire, broadest near the tip, sometimes obscurely notched. Annual.	Height to 6 feet. Stem coarse and branched or unbranched, hairy or closely and densely downy on upper parts. Perennial. Leaves large and coarse, to 20 inches long and to 8 inches wide, downy and rough above, the larger ones with long petioles, the smaller upper ones with no petioles but with clasping bases, conspicuously veined, entire.	To 5 feet high. Stem branched or unbranched, smooth or nearly so, somewhat ridged, stiff and somewhat coarse. Leaves, opposite, ovate, slender pointed with saw-tooth margins and rounded bases, usually slightly roughened, conspicuously veined, to 6 inches long and half as wide, sometimes borne in whorls of three. Perennial.	To 12 feet high, profusely branched, with stiff, somewhat ridged stems that are essentially smooth, or only slightly fuzzy, or with a bloom. Leaves are finely divided into 5-7 divisions with each division in turn deeply notched. Leaf may be more than 1 foot wide, thin, often downy above, with stem leaves the smaller. Plant is perennial and hardy.
Native of North America and found most commonly in dry pastures, meadows and roadsides. From New York and Pennsylvania to Manitoba, Texas, Arizona and Mexico, but less abundant in eastern portion of the range. A common plant in the prairies of the middle-West. 30 species in western North America, Peru and Chili.	Found over almost all of North America of which it is native but not found in extreme north. Also found widely distributed in Asia, Europe, South America and the West Indies. There are more than 150 species in the genus giving a wide geographic distribution. Most commonly found in fields and waste places.	Introduced from Europe and now well established in America along roadsides, overgrazed pastures, and in dry fields and meadows. From Nova Scotia to North Carolina and west to Missouri and Minnesota. Of more than 100 European species, this seems to be the only one to have established itself in America. Other species in Asia, Africa and Europe.	Native of North America and found from southeastern Canada south to Florida and west to Tennessee and the Dakotas, being found on occasion in isolated areas to the northeast. Of the 6 species found in the genus all are natives of North America. Ordinarily is to be found in swales, open woodlands, thickets and dry banks, usually mixed with other plants.	Native of North America. This species ranges from Quebec to Florida, west to Arizona, Colorado, Idaho and Manitoba, but is often found under cultivation as an ornamental, particularly in older long-established flower gardens and around old farm houses. Other species of the genus are also used frequently in cultivation. Favors rich low lands.
Heads have distinctly tarry or gluey feeling because of nature of surrounding bracts which have conspicuously backward bending tips. Inner ray flowers have both pistils and stamens, and the petal-like outer ray flowers bear pistils only. Ray flowers to 1 inch long or may be absent. Fruits are to 1/7-inch long, finely ridged and with 2-8 awns.	Flowers borne in small, slender, bell-like, erect heads, numerous, about 1/5-inch across. Ray flowers short, white, numerous, but relatively inconspicuous. When fruits have been shed, the base is rather conspicuous because of the persistent backward-bent bracts that enclosed the heads. Chromosome number is 18.	Flowers found in large heads at or near tips of uppermost branches. Heads are to 4 inches across and to 1 inch high, with outer flowers pistillate and central disc flowers with stamens and pistils. Rays are numerous, slender. Fruits are coarse, 4-sided, smooth, dry. Bracts enclosing heads are almost leaflike. Chromosome number 20.	Flowers borne in conspicuous heads that are to 3 inches across and terminal or axillary in the uppermost leaves or branches. Ray flowers are to one inch long and bear pistils that may mature fruits, yellow. Disc flowers bear both stamens and pistils and are also yellow. Fruits are smooth, to 1/5-inch long, without any terminal parachute. 32 chromosomes.	Flowers are in heads borne at the ends of the branches. Heads are to 4 inches across with 6-10 ray flowers each of which may be to 2 inches long, bright yellow, drooping or slightly recurved. Central flowers form a compact cone that is greenish-yellow and about twice as long as thick. Fruits are flattened, oblique at base and to ¼-inch long.
Flowers from June through September. May be considered a seriously poisonous forage for cattle where there is selenium in the soil. Elsewhere it is harmless. Herbs yield a diuretic, tonic substance used by some in treatment of asthma, whooping cough and kidney troubles. It is not unattractive as a roadside plant.	Flowers appear from June through November. A drug from this plant produces a dermatitis, sore throat, smarting eyes and sometimes prostration. It is diuretic, astringent, tonic, and is used in treating chronic diarrhea and in some types of hemorrhages. Common in dry hay, it may affect the skin of those who handle it extensively.	Flowers from July through September or later to south, with fruits being borne through October. Fruits are commonly heavily infested with insects. Plants are sometimes cultivated by dividing root systems in fall and setting divisions in rows with each row to 3 feet apart and sections 18 inches apart. Leaves considered questionably edible.	Flowers from early June through and beyond September with heads bearing fruits persisting into the winter. Differs from sunflowers in that the ray flowers may yield fertile seeds. Bracts of the structure that encloses the head are larger to the outside. Scientific name means that the flowers have the appearance of sunflowers.	Flowers from July through September, but colored heads persist until winter sets in. Well-known golden glow is a double-flowered form of this species, but either plant is an attractive fall flower, whether wild or cultivated. Plant has been suspected as being poisonous to hogs with properties similar to those found in belladonna and therefore serious. Not proved.
Presence of plant in pasture is considered by range managers as evidence of overgrazing practices. Control is effective by mild use of a low-concentrated 2-4-D, or it may be controlled by hoeing or by cultivation of ground before the fruiting time. It is not persistent on lands where crop rotation or open cultivation is the practice.	Plant yields readily to treatment with low-concentrated 2-4-D, by repeated cutting, by burning or by open cultivation practices. The ill effects on the skin may sometimes resemble trouble caused by poison ivy. Name possibly came from abundance of weed in horse pastures, but in spite of danger as skin irritant it has been used to rub down horses. This is probably unwise.	One acre may yield 1 ton of roots, with nation's consumption about 25 tons a year. Root used as drug that is aromatic, acrid, diuretic, expectorate. Root is powdered for medicinal use or fresh roots are candied in sugar and used as a medical confection, considered by some useful as cough cure. Plant is also known as scabroot, implying another use.	Apparently there are no medicinal properties recognized in the plant, nor is it poisonous. It yields readily to cultivation and so cannot be considered as a weed by farmers. This leaves its claim to fame primarily on the beauty of the flowers. It apparently has accepted this responsibility, because the flowers are attractive!	Weight of tops may often break the stems either of the wild or the cultivated forms. Therefore rigid supports are suggested. Plants may be almost covered with aphids or plant lice that are often red, so where flowers are to be picked the plants should be sprayed in advance with some spray that controls aphids.

COMMON NAME SCIENTIFIC NAME	BLACK-EYED SUSAN YELLOW DAISY *Rudbeckia hirta*	PURPLE CONEFLOWER *Echinacea purpurea*	GARDEN SUNFLOWER *Helianthus annuus*	WILD SUNFLOWER *Helianthus decapetalis*
DESCRIPTION	To 3 feet high. With few if any branches in the erect, stiff, brittle stem that is rough, covered with fine stiff hairs and usually dark-colored at least when mature. Leaves are thick, alternate, the lower with long petioles, to 7 inches long and to 2 inches wide with the uppermost the smaller.	Height to 5 feet. Stem smooth or covered with short rough bristles, branched or only sparingly so. Leaves alternate, rough, conspicuously veined, long- petioled, to 8 inches long and to 3 inches wide with shallow scallops on margins, the uppermost usually without any petioles. Perennial arising from thick, dark rootstocks.	To more than 15 feet high. Stem coarse, erect, rough-scaled, branched or unbranched, somewhat hollow but substantial nevertheless. At least the uppermost leaves are alternate, petioled, conspicuously 3-veined and with blade 1 foot or more across and pointed, rough on each side, and usually fuzzy beneath, in general heart-shaped. Annual.	Grows to 5 feet high but is usually lower. Stem is branched or unbranched, slender, rather stiff, smooth or nearly so and arising from a substantial and sometimes thickened rootstock. Leaves alternate above and opposite below, thin, to 8 inches long and to 3 inches wide, rough above and downy beneath, the lower ones with petioles.
RANGE AND RELATIONSHIP	Native of North America. Common in open dry meadows preferably where soil is somewhat acid. Favors considerable exposure to sun and so may persist in pastures where hot sun has removed some other plants from competition. Ranges from Florida to Ontario and west to Texas, Colorado and Manitoba. About 40 related species in North America.	Native of North America. Ranges from Georgia to Louisiana and north to Virginia, Ohio, Michigan, Illinois and Iowa with related species extending the range of the genus much farther to the west and occasionally found in isolated areas to the northeast. It thrives in open sun, in deep rich soils of the open prairie country.	Native of North America or Peru, but found in gardens from Minnesota to Texas and west to the Pacific and grown in fields and gardens widely over the world. Has been found apparently wild as far north as Saskatchewan. May establish itself where it has been under cultivation. At its best in rich garden or prairie soils.	Native of North America. Ranges from Quebec to Georgia and west to Missouri and Michigan, with closely related species extending the range. 75 species in the genus give it wide range on the whole but about 5/6 of the total are to be found within the United States. The sunflower is the State flower of Kansas.
REPRODUCTION	Flowers in attractive terminal heads with flowers of two kinds. Ray flowers are to 2 inches long, orange yellow, neutral and numbering from 20-40, notched or not at tip. Compactly crowded disc flowers are dark brown and produce fertile seeds. Fruits have no parachute and so cannot be windborne.	Flowers in huge solitary terminal heads, with 10-20 ray flowers, sometimes to more than 2 inches long and dark purple or rarely whitish, dropping or spreading conspicuously. Ray flowers are neutral. Disc flowers borne on a cone-shaped base, dark brown to black, bearing both pistils and stamens. Fruits are substantial, four-sided achenes.	Flowers in terminal heads, which may have a diameter of more than 2 feet. Ray flowers, yellow streamers, do not mature fruits, and much fewer than the disc flowers that bear both stamens and pistils and mature fruits and are purple to brown. Fruit is a flattened oval achene that may be light gray, black or striped but widest at the free end. Ch. number, 34 or 68.	Flowers are in good-sized heads borne at the stem and branch tips, the whole head sometimes being more than 3 inches across. Ray flowers are yellow and number 8-15. Disc flowers are tubular, bear both pistils and stamens and are crowded into center of head into a rather flat-topped formation, as compared with *Rudbeckia*.
ECOLOGY	Flowering season from May through September, with tops persisting often through the winter in identifiable form. May provide some doubtful forage for sheep where other pasturage is poor. May also provide some soil anchorage where soil is poor and otherwise with little protection. Races vary in fuzziness of cover and in length and color of the ray flowers.	Found growing either on acid or calcareous soils. Flowering from July through October, or even November, with fruits borne through the winter on the stiff dead stalks that persist. In some areas it may be considered as a pest, but usually it does not become dominant over plants growing in similar situations.	Flowers from July through September with fruit-bearing heads persisting into the winter. Root system may occupy a cubic yard of soil and 1 acre of sunflowers may lose nearly 400,000 gallons of water through transpiration. Fruits are sought by many seed-eating birds, particularly members of the sparrow family who may ruin a commercial crop if undisturbed.	Flowers from August into October, with the fruit-bearing stems persisting into the winter. Fruits of most of the sunflowers were gathered by the Indians and used as food either raw, crushed, roasted or salted. In many respects they equal salted peanuts, but their shells are not removed as easily.
ECONOMY	Flowers are sufficiently attractive to have been grown as ornamentals in some flower gardens, but farmers ordinarily consider it as a weed or as a sign of poor soil since it is rarely found in rich pastureland where other plants compete effectively. The plant is the Maryland State flower.	Control is simple, if plants are cut before seeds mature. While mid-Westerners consider it a weed, Easterners may plant it in their flower gardens and show it with pride. Certainly its beauty exceeds that of many plants that find encouragement in flower gardens, and the seeds may be bought in ordinary seed stores for use in growing as ornamentals.	Fruits make superior food for poultry and are highly favored for use at bird-feeding stations. Fruits are high in their oil content, and oil has diuretic and expectorant properties medicinally. Oil is used in making soap, as food and for treatment of leather. Plant has been under cultivation in the American Southwest since before 1000 A.D.	Roasted sunflower fruits have been used in the making of a coffee substitute but it is unquestionably of inferior quality. This species, found most commonly, is not listed as a bad weed largely because it does not grow where cultivated plants are to be found, and because it yields readily to almost any control measure.

BUR MARIGOLD PITCHFORKS *Bidens frondosa*	SNEEZEWEED *Helenium autumnale*	OXEYE DAISY WHITEWEED *Chrysanthemum leucanthemum*	TANSY *Tanacetum vulgare*	CHICORY BLUE SAILORS *Cichorium intybus*
To 5 feet high, with stems stiff, branched, smooth or nearly so, purplish when mature. Leaves opposite, usually smooth but sometimes roughened, thin, to 4 inches long and to 1 inch wide, with the lowermost divided into 3-5 segments with the terminal one particularly long-pointed, long-petioled and with a groove on the upper side of the petiole.	Height to 6 feet or even more. Stems are conspicuously angled and winged, branching freely in upper portions, pale green, slender or stout, smooth or meekly downy. Leaves alternate, coarsely toothed, to 5 inches long and to 2 inches wide with blades pointed at each end and petioles forming narrow wings that extend to the stems.	To 3 feet high. Stem erect, green, somewhat ridged, slender, nearly smooth, usually unbranched, arising from a short, thick, horizontal, perennial rootstock and a leaf rosette that remains green through the winter. Leaves to 3 inches long, dark lustrous green, the lower with relatively long petioles and conspicuously toothed margins.	To 3 feet high. Stem may be profusely branched in the upper areas, or may be wholly unbranched, smooth or downy, stiff, rather brittle, strongly scented when broken. Leaves to 1 foot long, deep rich green, dark, alternate, featherlike with division petioled, with upper leaves and lower leaves in general similar but smaller above.	To 4 feet high, with well-branched stems, erect, hollow, green changing with maturity to purplish or red or brown, tough, wiry, difficult to cut with lawn mower, woody when mature. Leaves much like those of a dandelion and in rosettes; may be confused with them, to 6 inches long, the lower with long petioles and the upper without, with deeply toothed margins.
Native of North America from Nova Scotia to Florida and west to California and British Columbia, with some 75 other species extending the range of the genus considerably. It has been introduced and established widely in southern Europe. Grows best in wet pastures, gardens and along wet roadsides but it is not too particular about sun or shade.	Native of North America, where this species is found from Quebec to Florida and west to Arizona, Nevada, Oregon and Manitoba, reaching to 2000 foot elevation in Virginia. All of the 24 species of the genus are native of North and Central America. Favors swamps, wet and flooded lowlands, often being at its best in gravel or gravelly soils.	Native of Europe, but too well established in American pastures, meadows, waste places and roadsides through most of North America. Less abundant in the South and the West. It is abundant in Asia and well established on other continents. There are some 100 species in the genus, few of which are to be found in America. Some are of value as greenhouse plants.	Native of Europe but well established in North America largely as an escape from flower or herb gardens. Established from Nova Scotia to Georgia and west to Nevada and Oregon and particularly common in East around abandoned farm homesites. Of the 30 species in the genus two are established in eastern United States and in California; others in Eurasia.	Native of Europe but too well established in fields, waste places, gardens and roadsides of America from Nova Scotia to North Carolina and west to California and Manitoba. Of the 8 species, all are native of Europe and only this one has established itself in America to any considerable extent. It grows in almost any kind of soil and may crowd lawn plants out.
Flowers in many heads borne at the tips of the uppermost branches. Each head is to 1 inch wide and about ½ as long. Ray flowers may be absent or inconspicuous. Disc flowers are orange and produce flat, black, two-awned fruits that cling readily to clothing or fur and may be carried far by animals. Heads enclosed in leaf-like bracts.	Flowers in showy terminal heads that may be more than 2 inches across, with 10-20 drooping, yellow, ray flowers that may be each more than 1 inch long and are conspicuous because of the 3 well-defined teeth at the free end, and ray flowers may produce fertile fruits. Ray flowers are pistillate. Disc flowers are darker yellow and form spherical heads.	Flowers borne in heads from May through November and sometimes into December. Heads are to 2 inches across. White ray flowers number 20-30. They are flat, with 2-3 teeth at the free end. Disc flowers, small, densely crowded into a disc that may be depressed in center. Chromosome number, 36. Fruits small, black and white striped, without parachutes.	Flowers borne in many relatively small heads crowded at branch tips, the whole forming a flat-topped structure. Individual heads are to ½-inch across and are yellow with most of the flowers tubular, although there may be some marginal ray flowers. As is usually the case, the ray flowers are pistillate while the disc flowers bear both stamens and pistils.	Flowers are in showy heads arranged along the upper portions of the stem. Heads are to 1½-inch across and are commonly grouped with up to 4 being close together but only one of the cluster seems to be open at one time. Flowers are all alike, blue or white, with notched tips and all may yield fertile fruits, so reproductive capacity is tremendous. Chromosome number 18.
Flowers from July into October and fruits persist to some extent through the winter. Since plants require much moisture, drainage provides one good means of control but cutting before flowering may be effective although the seeds remain virile for long in the soil. Chromosome number is 12. Plants yield readily to mild 2-4-D treatment, with one application.	Chromosome number is 34. Flowers appear in August and through October with fruiting time extending through November. A bitter substance is found throughout the plant but particularly in mature flower heads which, if eaten, creates a strong desire for more. Powdered flower heads used medicinally to stimulate sneezing.	Fresh vegetation in spring makes a delicious salad. Control is possible largely by cultivation and cutting tops before the seeds mature. Seeds are commonly distributed through stable manure. Heads are commonly heavily infested with thrips, small insects that crawl readily when exposed but apparently do not provide an adequate check on multiplication.	Flowering time extends from June through September and fruits are to found into early winter. Chromosome number is 18. Leaves and stems contain drug tanacetin that may be poisonous if eaten by man or domestic animals. However, it has been used in a tea for some purposes. Propagation is by seeds or by division of underground parts.	Flowers from July through October being at the best usually early in the morning. Fruiting time extends from August through the winter or to mid-winter. Fruits are inconspicuous straw-colored, without a conspicuous parachute. Young leaves have some value as a slightly bitter salad plant, but if plants are repeatedly cut and well-watered may be considered good.
Fruits in wool of sheep may cause mechanical injury to skin and serious infections may result. In Africa, the leaves of a related species are made into greens and used as food, but somehow this does not seem to appeal to those who smell our own plant.	Cattle and sheep may develop appetite for plant, the eating of which may cause accelerated pulse, difficult breathing, staggering gait, spasms, sensitiveness to touch and convulsions that may end in death. It is therefore not a desirable pasture plant. It fortunately yields readily to cultivation, drainage, cutting and low concentrated spray of 2-4-D.	One control technique is to salt the rosettes making them more palatable to grazing animals and also weakening the growth of the plants themselves. Young leaves often used as pot herbs. Plants resist 2-4-D treatment rather remarkably, even when treatment is repeated. This is the State flower of North Carolina.	For commercial purposes tops are cut when in full flower in late summer and are dried. 1 acre may yield 1 ton of dried leaves that has had a market value of 20 cents a pound, with the extracted oil worth to 2 dollars a pound. An average acre can be made to yield about 20 pounds of oil. Plant resists 2-4-D strongly.	Roots may be dug just after flowering ceases, then ground, roasted and used as a coffee substitute or as a deliberate adulterant of good coffee. Some prefer it to coffee. During time of war it has been used as a means of extending supply of coffee but this requires imagination at times.

(*Continued from page 475*) mixed these types in different ways. Much of this, of course, is academic; but its recognition requires some discipline in orderly thinking, and experience in this field may prove of great value.

It would be worth while to investigate the pollination story in these plants, and to notice that while some of the flowers are wholly pistillate, most of them contain both pistils and stamens. Usually it will be noticed that the flowers not bearing stamens are borne around the outside of the disc heads of which they are a part. In relatively few of the composites do we find the pistillate and the staminate flowers borne on separate plants, but in the case of the ragweed—where this is the case—the flowers do often have a considerable effect on people living in the neighborhood, and sometimes on the economics of a community. The incidence of hay fever in these areas is commonly conspicuously tied to the seasonal production of large quantities of air-borne pollen, making the communities unfit as retreats for people afflicted with respiratory troubles.

Some of the stories about the botany of these plants may be checked with the simplest of observations, but this is not true of all. It would seem to be obvious that the brilliant color of dandelion blossoms and the presence of bees crawling over dandelion heads might suggest a cause and effect relationship between the visit of the bees and the production of virile fruits. Cytologists who study the details intensively tell us, however, that in many cases no pollination takes place; and yet we all recognize that dandelions are able to produce an abundance of fertile fruits, so it is obviously unwise to jump to a hasty conclusion.

It would be a mistake to conclude that we know all that can, or should, be known about the habits of these plants. In fact, we know little about the time necessary for many of these plants to go through the cycle from fertile seed to fertile seed. Knowledge of this kind might, in many cases, provide us with some of the keys to management.

We used advisedly the term "fertile seed" above, because, to the technical botanist, the "seeds" of all of the composites—like the "seeds" of the grasses and of some other groups—are really one-seeded fruits. So, if you are interested in semantics, the science of meanings, you do not sprinkle sunflower "seeds" on your bird-feeding station, but sunflower "fruits." Apparently many precollege textbook writers are wholly unaware of this.

Perhaps it would be best to conclude this discussion by turning again to the poets. For the most part, poets deal with impressions, not challenges to our intellect, appeals to our pocketbook, or the strains of our backs. Digging weeds requires physical strength. Allowing them to grow in some places affects our bank balance. Understanding their structure, physiology, development and relationships puts demands on the best of brains. But simply enjoying their beauty, and possibly drawing a few far-fetched comparisons, may be relaxing and comforting.

"Even death-doomed men
  However they may lock their brains
Fall dreaming now and then,
  And see the white-topped daisy-fields
Go marching up a glen."

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Speaking of Wilderness

An Editorial

When Chairman James E. Murray of the Senate Committee on Interior and Insular Affairs announced recently a series of field hearings on the Wilderness Bill in the West, he issued conservationists a challenge that they should be prompt in accepting and meeting.

The hearings have been scheduled for Bend, Oregon, November 7, San Francisco, November 10, Salt Lake City, November 12, and Albuquerque, November 14. Senator Richard L. Neuberger will conduct the Bend and San Francisco hearings, Senator Murray himself the hearings in Salt Lake City, and Senator Clinton P. Anderson the final one in Albuquerque.

We can be sure that those opposed to making wilderness preservation a firm national policy will do their best at the hearings to attack this measure, which conservation forces have been developing for more than a decade. It is a proposal that has been designed to fit into existing programs and to avoid conflict with other interests, but so far the representatives of the other interests involved have seemed slow to recognize this. If they still are unconvinced by November we can expect to see them at the field hearings in November—stockmen, lumbermen, mining interests, and others—objecting vociferously to this sound proposal to save some of our national lands for wilderness.

Conservationists must accordingly be sure to be at these hearings in force, ready to demonstrate that Americans really are interested in wilderness, ready to point out that this is indeed a reasonable program that does not harm lumbermen or other interests, and prepared to urge that it be enacted as promptly as possible while our wilderness preservation opportunity is still here.

Senator Murray, himself a friend and co-sponsor of the Wilderness Bill, has acted with commendable promptness and decision in taking opponents of the bill at their word and scheduling this series of hearings in their own western regional centers.

When proponents of the Wilderness Bill, a year earlier, sought to have field hearings arranged, Senators opposing the measure objected. Apparently they did not want to have the bill publicized and given the advantage of such hearings.

When, however, widespread public interest in the legislation was apparent and its opponents faced the possibility of enactment in the 85th Congress, the prospect of hearings that could not be held until after Congress's adjournment seemed very enticing indeed.

"Insistence upon hearings in the West," as Conservation Director Charles Callison of the National Wildlife Federation puts it, "was a final maneuver by opponents to prevent action on this important legislation in the 85th Congress."

But even as *American Forests*, a perennially imaginative fault-finder as far as the Wilderness Bill is concerned, admits, the proponents of the bill withdrew from the 85th Congress "in good order with their hand visibly strengthened for a renewed assault next session." Enactment in the 85th Congress was predicted by many, and the field hearings to be held during the Congressional recess were recognized as a live transition to the 86th Congress.

It is indeed time to see this wilderness policy and program finally enacted. More than seven years ago it was, on our June-July 1951 editorial page, that we first enlisted in its support. "The time has come," we said then, "to move positively and translate the wilderness thinking into specific terms of legislation." We saw this then "as an opportunity and a challenge to shift from the defensive to the offensive," and we have since continued to urge it along as an outstandingly important constructive program.

The bill is needed because without its Congressional sanctions the administrative programs so far successful can not be counted on to endure in the face of pressures that obviously are increasing. It is urgent because the opportunity now to establish a wilderness policy and program without conflict can not be expected to last.

These are understandings that conservationists have had for some time. It is time now that they express them forcefully. These hearings offer each of us who resides within the western States an excellent personal opportunity to do so.

As Senator Murray has suggested, everyone interested in testifying should notify him at once—Senator James E. Murray, Committee on Interior and Insular Affairs, United States Senate, Washington 25, D. C.—and tell him where the statement should be made—Bend, Oregon, November 7; San Francisco, California, November 10; Salt Lake City, Utah, November 12; or Albuquerque, New Mexico, November 14.

Those unable to attend hearings are invited to send statements to Chairman Murray and indicate at which hearing they should be entered in the record.

Thus by written statement, or better still by testimony, every conservationist in these western States is given a personal opportunity to stand up and be heard in support of preserving some of our American wilderness wild and unspoiled.

The Porcupines and Copper

By JACK VAN COEVERING

Along the Mirror Lake Trail in the Porcupine Mountains State Park may be seen a stand of virgin hemlock and hardwood, passed over in earlier lumbering days because of the rough nature of the terrain.

SHALL Michigan allow a copper mine to operate in its Porcupine Mountains Wilderness State Park on the shores of Lake Superior? This is a question that has stirred the public as has no other question in the history of conservation in that State.

Letters are pouring into the Lansing office of the State C :rvation Department at a rate that not even the oldest employe can remember. More than ninety percent of them protest despoliation of the park, and the protests are no mere form letters. They represent no single class, no single interest. They cut across social, economic and educational lines. Some are written on fine paper, others on postcards. Some are typewritten, others laboriously composed with pen and ink. In the files of the Michigan Conservation Department, there are protests not only from Michigan, but from all over the nation; not by the hundreds, but by the thousands.

"I am not a member of an organized sportsmen's or conservation group, nor do I have the time to write more than extremely rarely to persons concerned with public issues of the day. . . My family enjoys camping . . .in areas which resemble, at least to some extent, the original wilderness this country possessed. . ."

"There is great need to preserve this area for the ethical, spiritual, and educational value for generations to come. . ."

"Inasmuch as copper mining is continuing now only by subsidy of the Federal Government, there can be no valid economic excuse for developing new mines at this time. . ."

"We have something fine in Michigan's wilderness area. My son, now in California, still prefers camping

Gull Rock, below, is in Lake Superior just off the shoreline of Michigan's Porcupine Mountains State Park, and adjacent to a part of the area that has been proposed as a site for copper mining.

From a rocky escarpment in the Park, the visitor may view the beautiful blue Lake of the Clouds, which is easily accessible from road's end and lies more than a thousand feet above sea level.

Photographs by the Author

For those willing to pack in over a foot trail of two or three miles, there is a cabin at Mirror Lake available by reservation. Similar cabins also are available at other sites.

in the Porcupines. Let's don't spoil the finest, almost only, wilderness in the Middle West."

Thus the letters read. The words are different, but underlying all is a fear that the wilderness area of the Porcupines will be lost, and with it something that can never be replaced.

To be sure, there are letters favoring a mine development, practically all from business folks in Michigan's Upper Peninsula, where the Park is located. There are resolutions from Chambers of Commerce, Rotary Clubs, and City Councils. All of them sound this note: "The economic considerations far surpass the notion that this famous wilderness might be despoiled." "We think the time has come to utilize the natural resources to provide an economic future for those who live here."

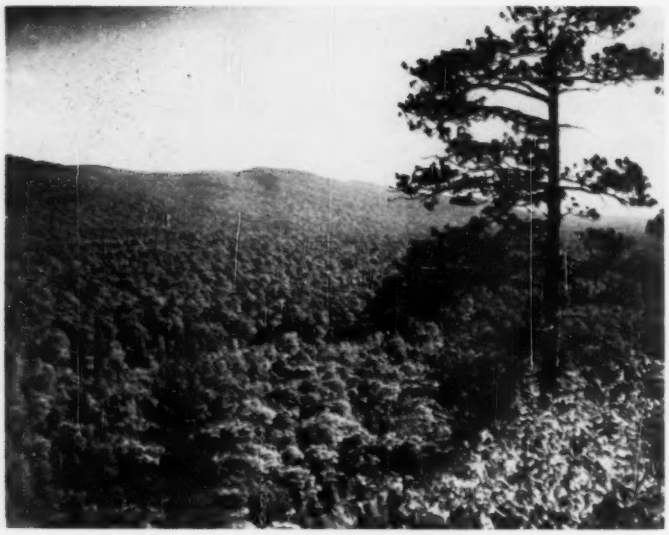
The stakes are high. A copper mine operation that will employ perhaps 1000 people for upwards of twenty-five years, or a wilderness area that is unique and irreplaceable. Proponents of the mine insist (although with more hope than realism) that the wilderness will not be spoiled by the mine. They believe they can have their cake and eat it, too. Those opposed to the mine feel certain that the "cake" will not be there after it is eaten. Thus the battle continues between preservation and development.

The Porcupine Mountains State Park covers a big area—seventy-five square miles. It comprises a series of rocky, tree-covered hills, often more than 1000 feet high. Loggers missed the lumber because it was too expensive to take out in the "lumbering days." As a result, there is now this great area of hemlock-hardwood forest, untouched by the lumberman's saw and ax. It is a wilderness, not much changed since the white man first saw it. It is a large area, but, comparatively speaking, only a small remnant of the "great uncut."

Because it is the only remaining significant patch of virgin hemlock-hardwood forest, it is of national importance. In 1942, it was being considered for a National Park. In fact, the Porcupine Mountains were included for purchase in bills introduced in both House and Senate of the United States that year. At that time the late Professor Aldo Leopold, of the University of Wisconsin, wrote this about the "Porkies:"

"I would like to see the Porcupine region acquired and preserved as an act of national contrition, as the visible reminder of an unsolved problem, as a token of things hoped for. To this end, it had better be kept roadless, axeless, hotelless, and open only to ski or foot travel."

Subsequently, the State of Michigan purchased the



Looking in a southwesterly direction from the Lake of the Clouds, the visitor sees an unbroken expanse of tree-tops, a part of the more than forty-three thousand acres of a great natural area.

People who know the Porcupine Mountains say that a visitor has not really seen the area until he has visited Mirror Lake and its nearby hemlock grove, shown in the photograph below.

"Porkies," and its Conservation Commission dedicated 43,453 acres of it as a natural area. Outside this dedicated area, there is a little more acreage in which a ski-run is the main tourist development. The proposed mine site, however, is precisely in the middle of the dedicated natural area, along the Lake Superior shore. The Conservation Commission has authority to lease for mining in the Park.

The beauty of the Porcupines is the beauty of shimmering lakes, green vistas, white water tumbling over rocks. The rivers in the Porcupines are unpolluted from source to mouth. Chief attraction, which all tourists see because it is easily accessible from the end of the road, is the Lake of the Clouds. There, more than 1000 feet above sea level, lies a clear blue lake in emerald setting. The visitor sees it from a rocky escarpment, then looks over tree-tops that extend to the far horizon.

Most people see little more of the "Porkies" than that; but they leave with the knowledge that, "inside," there are trails and cabins that "some day" they may want to explore. For most, of course, that "some day" never comes; but life is freer and more worth living because they know that the wilderness is there, and the opportunity to enjoy it will always beckon.

The Carp River flows from the Lake of the Clouds toward Lake Superior. ("Carp" is simply lazy English for " 'scarp," or "escarpment.") A few weeks ago, while gathering material for a report on the Porcupines in the *Detroit Free Press*, Ken McCormick and I went by open boat on Lake Superior to the mouth of the Carp River. There, at the edge of the lake, a giant boulder of conglomerate greeted us. It was the biggest chunk of conglomerate we had ever seen. It was silent testimony to the tremendous power of glacial ice in the distant past.

To have a closer look at the Porkies, and to get the "feel" of the area, we walked upstream. It was a steady climb. The river fairly leaps and tumbles as it drops 500 feet in nine miles. There are more than 100 falls and rapids. A trail sign, built of sturdy lumber, was scarred, pawed and splintered. There was tough black bear hair on the splinters. A belligerent bruin had pawed it thoroughly.

Nearby, the Little Carp River falls 1000 feet in 14 miles, in almost one continuous rapid, and thus it is with the streams in the Porkies. They are swift, clear and beautiful. The Presque Isle River alone has forty or fifty falls in its last mile before emptying into Lake Superior. At this point, we asked our guide, park forester Joe Calaboro, what effect a mine might have on these lovely rivers.

"The Carp River is the one that drains most of the

area," he said. "If there are any wastes, they would certainly go into it."

People who know the Porcupines say that you have not really seen the area until you have visited Mirror Lake. The trail is several miles long. Near the lake there is a hemlock grove that reminds one of Longfellow's "forest primeval. . .the murmuring pines and the hemlocks." This, remember, is Hiawatha-country.

Walking along the trails, you forget the affairs of everyday. This, indeed, is a forest primeval; the great uncut; a bit of frontier left as a museum piece. When I walked there, I thought it would be a sacrilege indeed to build a mine on the doorstep of such a cathedral. To deprive our children of such a sanctuary would be to rob them of a birthright.

But the arguments of the mine proponents keep pounding in the public's ears. Only 900 acres are involved, they say; such a small portion of the park! And that is along the Lake Superior shore, where shore-logging and fires have taken away the virgin trees already. "We won't touch the virgin forests on the inside," they say. "Just let us have the mine site. Look at the payrolls that will come. Consider the taxes the mine will pay. And why not use some of these taxes to improve other parks?" Thus the siren song.

No mention, or at least very little mention, is made of the fact that a mine must have workers, who must have access roads. A mine must have power, which must have transmission lines. A mine also must have supplies, which means roads or railroads. And what about the huge amount of powdered rock—mountainous tons of it that is waste after the copper is extracted? "We'll dump that into Lake Superior," they say. But that has never been done before, and it may be only wishful thinking.

As for leaving the interior of the Porcupines in its primeval state, there are already voices speaking up for "lumbering the mature trees in the park." "It would be wise utilization of the forest resource," they say. So opening the door for a mine will swing wide another door for the lumbermen!

These voices have little understanding of the wilderness idea, of natural areas, or of a great experimental museum where foresters may investigate Nature's workings without man's interference. As Dr. Stanley Fontanna, dean of the University of Michigan School of Natural Resources, stated:

"Having this great northern hemlock-hardwood forest in relatively untouched state. . .gives the forester a chance to check and measure changes over a period of years under natural conditions to see what happens to various species composing the stand. Silviculturally, there is much to learn here which will be helpful in the management of northern hardwood forests. Historically, this is a means of preserving an area of a type which is fast vanishing. . ."

Michigan's Porcupine Mountains Wilderness State Park is important, not only to the Wolverine State, but to the whole country. We all have a stake there. Wildernesses are already too few. If the Porcupines go, then, in Aldo Leopold's words, "There will be an end to cathedral aisles to echo the hermit thrush or to awe the intruder. . .The forest primeval in this region will henceforth be only a figure of speech." ❦ ❦ ❦

FROST PALETTE

Last night, while all the earth lay sleeping,
Autumn came to our garden, creeping
In on quiet tiptoe, passing tender bud and flower,
Pinching each and every one, 'til all had lost
The glow that had been theirs. Poor things!
They lay in sad array, brushed cold by Autumn's frost.
But now, look there! See all the trees!
The frost had stolen flame of marigold
And spread it over leaves of cherry bough;
While maples, strutting down the avenue
Flaunted the scarlet banners that had danced
Along the garden path the summer through.
The oak, down at the corner, wore a cloak
Of gold and crimson that had once belonged
Along the wall in beds of hollyhock.
The velvet red of roses, now lying dead,
Revealed itself in ivy. Overhead
The blue of larkspur seemed to lie
Snatched from the earth to deepen Autumn's sky.
The seasons change and in each change portray
The miracle of Nature through the years
Renewing life with life and fusing all
To one harmonious whole. Thus we see
God's promise to the world—Eternity.

E. Graham Ward

PHOTOGRAPH BY RUSS KINNE

An aerial photograph of the southern part of the Exumas park project in the Bahamas Islands shows some of the many coves and inlets that teem with under-sea life. So clear is the water that fishing boats sometimes seem to be suspended in mid-air.

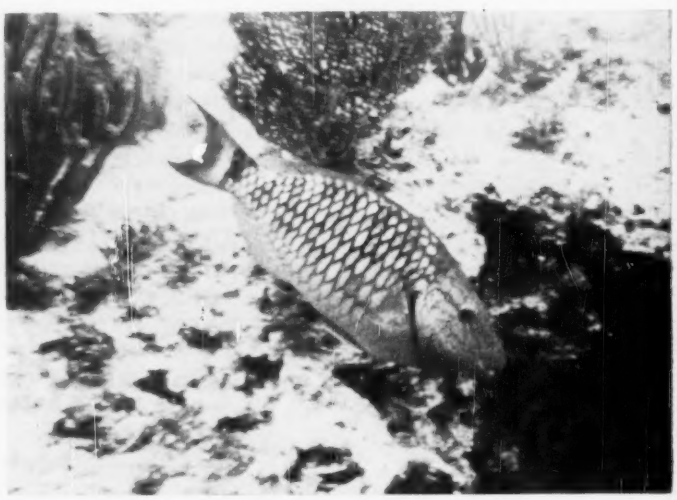
An Under-Water Park

THE conservation of land resources and the protection of land flora and fauna, as well as the preservation of wilderness areas, are all well-accepted ideas today, thanks to the courage and unceasing efforts of certain dedicated groups and individuals who have made the general public aware of our obligations to posterity

Perhaps because the seas are so vast, covering nearly three-quarters of the earth's surface, and are so full of myriad forms of life as to seem inexhaustible, comparatively little thought has been given to the protection of oceanic life, particularly along the offshore banks, shelves and reefs, where it is most abundant and varied.

But, as the world's population grows, and as airlines and swifter ships make once remote islands and distant seacoasts accessible, the question arises as to how these shallow-water areas, the normal breeding and maturing places of much under-sea life, can be safeguarded from the encroachments of civilization.

One of the regions most acutely aware of this looming problem is the Bahamas, that beautiful archipelago whose hundreds of islands are strewn in charming abandon over their own broad oceanic shelf, east and south of Florida. For many years the Bahamas were the



The red parrot fish, one of the most spectacular of the reef dwellers in the Exumas, about to feed. It has been learned recently that the adult male can change from red into a brilliant green, with blotches of yellow and other bright colors.

PHOTOGRAPH BY CARLETON RAY

sedate winter resort of yachtsmen and other persons of wealth. Most of the "Out Islands," on the fringes of the Colony, were sparsely populated, and as little visited as they were 466 years ago when Columbus first set foot on them, to open a New World.

But that was before air lines, and air-conditioning, and budget vacations. These, and other inducements, have made almost every nook and cranny of the Bahamas available as well as desirable. A tourist-conscious government also has placed the Out Islands, as well as Nassau, the capital, within the price range of the middle income group of the United States and Canada.

The net result today is a tourist, trading and building boom that recalls, on a small scale, the Florida frenzy of a few decades ago. Because Bahamas waters teem with hundreds of kinds of fishes, as well as some of the most spectacularly beautiful coral reefs in the world, visitors naturally turn to the sea with rod and reel, and, more recently, with skin-diving outfits, to photograph, to spear fish, or to gather coral and other souvenirs from the reefs.

Alarmed at the partial despoiling of some of the "sea gardens" around Nassau, a group of conservation-minded Bahamians and Americans met last winter in Nassau to urge the preservation of some especially fine reef and shore areas in the Bahamas, as yet unexploited, that might be forever set aside as a "land-and-sea-park."

By

E. JOHN LONG

Spear fishermen and coral collectors, the group admitted, were not the only ones disturbing marine environments as the Colony's population continued to grow. Harbor dredging and seaside real estate developments, new shore resorts, and the dumping of debris and pollution can all play a part in the destruction or dispersal of under-sea life.

Colonel Ilia Tolstoy, grandson of the famous pre-Communist Russian novelist, and Dr. Carleton Ray, of the New York Aquarium, leaders of the park planning committee, after much study and many visits to the Out Islands, recommended a section of the Exuma Cays. These small islands, lying between vast shoals to the west and the great depths of Exuma Sound to the east, seemed destined for such a role. Although they lie within easy sailing distance of Nassau, most of the Exumas are still Crown land, and virtually unsullied by man.

On a large-scale map of the Bahamas, you will find the Exumas in the middle of the 450-mile-long archipelago, and also about midway between the eastern and western islands. The cays—from the Spanish *cayos*, or small islands, but pronounced "keys"—themselves consist of a curving chain of about forty low islands and a great number of smaller islets and rocks, extending 130 miles in a southeasterly direction from a point about twenty-five miles southeast of New Providence.

The actual park area, however, is a twenty-two-mile sector of small cays and adjacent waters near the upper sector of the chain, extending from Wax Cay Cut on the north to Conch Cut on the south. Of the ten islands in this segment, seven belong to the Crown and three are under lease. However, the lessee of Cistern Key, one of the three, has enthusiastically endorsed the park project, and asked that his island be made an integral part of the undertaking.

Almost all of the settlements in the Exumas are at the southern end of the chain. George Town and the nearby Stocking Island Yacht Club have facilities for visitors, including an airport and a modern inn. But those who want to see the park area at close hand must live aboard their boats, or camp out ashore.

From the air, you will feel sure that the Exumas are the most beautifully situated islands in the world. The islands themselves are a drab green, but the restless seas that encircle, cut into, or flow through them are breathlessly lovely. Colors run a great gamut, from vivid turquoise through pale greens and blues to the dark blue of the ocean depths. Every mile of this opalescent fairyland reveals some new and fascinating wonder, whether it be a vest-pocket harbor with a fishing boat seemingly suspended in air in the clear waters, a curving necklace of pink sandy beach, waves splashing high over a fringing reef and flinging rainbows into the air, or a giant manta ray, its snout up, sunbathing in the shallows.

Within the crystal-clear seas of the Exumas you will find almost every variety of fish and most of the other forms of marine life known to the Bahamas. Land vegetation is not so spectacular, yet it includes such unfamiliar growths as sabal palmetto, red mangrove, lignum vitae (one of the hardest of woods), silver thatch palm, *Epidendrum*

A pair of French grunts seem about to press their mouths together in a reef-side rendevous. At the left is the staghorn coral, and at the right is gorgonian, or soft coral. The French grunt is one of the common fishes of the Exumas reefs.

PHOTOGRAPH BY CARLETON RAY

PHOTOGRAPH BY RUSS KINNE

Two skin-divers swim over a typical Bahamas reef in the Exumas, exploring the wonders of the under-water realm. Particularly noticeable here are the many varieties of coral, including the staghorn, brain and gorgonian.

orchid, and the dildo cactus, along with the commoner plants.

Even if the Exumas lacked exceptional sea life, the islands would merit protection as a bird sanctuary. Of the 200 species of birds that dwell in or visit the Bahamas, a good percentage lives in the thickets and sea cliffs of the Exumas, or touch base there during migrations. These include such rareties as the Woodstar hummingbird, palm warbler, bananaquit, red-legged thrush, royal tern, and great blue heron, as well as the commoner gulls, plovers and ospreys. The once plentiful white-crowned pigeon has been hunted nearly to extinction, but it responds to protection, and might stage a comeback in the park area.

Sponsors of the project have high hope, too, of restoring that most stately of Bahamian birds, the flamingo, to the islands. These beautiful pink creatures now nest only on Andros and Great Inagua Islands. Since they have been protected by law, the colonies in these two islands have greatly increased. Some of them might be successfully transplanted to the Exumas, a former flamingo nesting place.

Other land life includes a non-poisonous snake, the Bahamian racer, the curly-tailed lizard, and the native iguana. Because the latter is sought as food by the natives, it is in need of immediate protection, as are also the green turtle and the hawksbill turtle.

But it is the life under water, and particularly in the neighborhood of the coral reefs, that most commends the Exumas as a park site. It might be mentioned at this point that the proponents of the park project would not have ordinary rod-and-reel fishing restricted. Nor would skin-divers be barred, if they came to observe and photograph. But spear fishing would be forbidden, as would be the removal of coral and other fixed forms of under-sea life.

Even when viewed from a glass-bottomed boat, it is readily apparent that the reefs of the Exumas are exceptional; that here submarine life still goes on in its primordial fashion. With diving gear, either helmet or skin-diving, yet another wonderland is revealed. On some islands the reefs are not far from shore, and may be viewed easily from the sandy bottom in depths of less than fifteen feet.

Picture a backdrop of staghorn and brain corals, and swaying sea fans and gorgonians, before which a continuous pageant of beautifully colored fishes glide or dart by. Blue demoiselles, red squirrel fish, yellow grunts, angel fish, snappers, parrot fish, wrasse and scores of others weave fantastic patterns of color and motion as they swim in and out among the openings in the reef. Here a spiny lobster peers cautiously from a rocky den, and a great conch tugs its heavy shell over the sandy bottom. Now and then a ponderous grouper glides by. No two moments are alike in this strange, soundless world, the doorstep to Neptune's realm.

Even the surface of the sea has its day in the Exumas. The southernmost end of the chain comes into the news each spring as the setting for the "Out Island Regatta." This "poor man's Cowes" is a series of work-boat sailing races, restricted to weather-beaten craft that spend most of the year hauling fish, vegetables, fruit, sponges and native passengers between the far-flung islands of the Colony.

The annual Regatta is an exciting event, sparked by many valuable prizes and spirited betting between rival boat crews. Five different classes of work-boats compete, and there are no rules except that boats must not collide. If two or more boats are in danger of hitting each other, all must come about, although the maneuver is often delayed to the very last second. The Regatta, which native skippers call "regretta," was the idea of an American resident of George Town, who became interested in helping the Out Islanders.

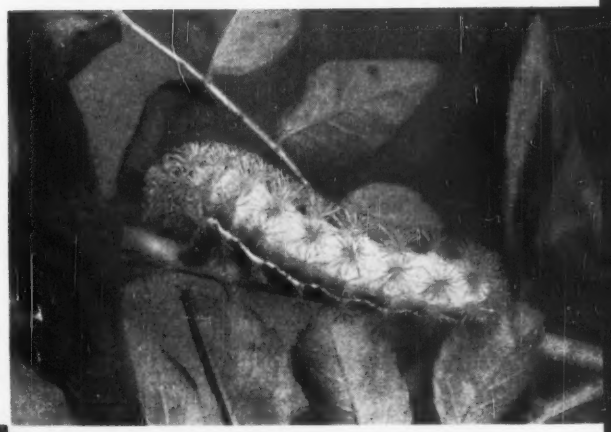
Actually, the concept of a land-and-sea park, while unusual, is not entirely new. Marine fringes of the Everglades National Park were prime selling points in establishing this wonderful wilderness area as a wildlife preserve. Biologists now urge that the park boundaries be extended to include Key Largo and its splendid offshore reefs, especially Largo Dry Rocks. A study is being made of the waters adjacent to the Virgin Islands National Park, to determine whether they should not be made an integral part of the Park.

Three National Monuments include under-water preserves: Fort Jefferson, on Dry Tortugas, sixty miles west of Key West; Cabrillo National (*Continued on page 498*)

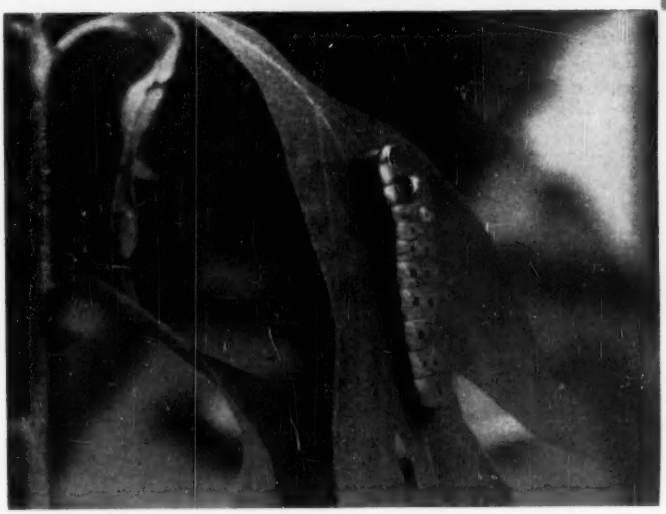
The Versatile Caterpillar

By ALICE L. HOPF

Photographs by the Author



The larva of the Io moth is the only poisonous caterpillar in this country, and the defensive spines have been known to inflict painful stings. The author, however, had no trouble in picking up the above illustrated specimen.



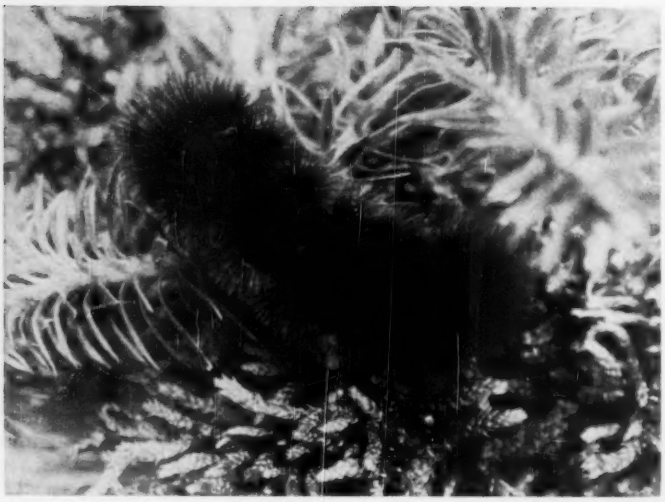
A full-grown larva of the butterfly *Papilio troilus*, at left, is resting on a leaf of its food plant, the sassafras. This caterpillar has an elaborate system of markings and eye-spots as a protective device.

If you asked the man in the street to define the word "caterpillar," the chances are that he would come up with something like "a weak, defenseless worm that eats vegetation during the summer and, after spending the winter in a cocoon, emerges as a butterfly or moth."

He would be wrong on almost all counts. The caterpillar is a highly versatile and successful life form. It has worked out some quite effective defensive tactics. It has a variety of ways and places for spending the winter, and it is not even exclusively herbivorous—there are a few kinds of caterpillars that are meat-eaters. Finally, this lowly worm is not entirely confined to living on land. In some cases it has been known to make its home in water, and even to take to the air!

The family of butterflies known as Papilionidae, or swallowtails, has a large assortment of defensive methods while in the larval stage. To begin with, the larvae use camouflage. When small, some of the larvae manage to look convincingly like the droppings of birds. They seem to feel, also, that there is nothing like a good hiding place, and they have a technique of folding over a leaf so that they can lie concealed within it. They spend most of the time inside, except when eating, and should they be disturbed in their little fortresses, they are able to resort to chemical warfare. Rearing their heads into the air, they shoot out two orange protuberances that emit a strong, unpleasant odor. All in all, *Papilio* is a pugnacious caterpillar, and is far from being defenseless against the attacks of predators.

When winter approaches, most caterpillars turn into a pupa, or chrysalis, and in this inert form hibernate until the warm weather of the following spring triggers the process that changes them into their adult form of butterfly or moth. Some caterpillars burrow into the ground before pupating, while others make a cocoon of leaves, or of their own silk or hairs. Still others fasten themselves to a twig or branch and, hanging thus, make the change to a chrysalis. There are exceptions, however, like the familiar "woolly bear" caterpillar. These creatures, with their warm "fur coat" of brown and black hairs, wander about all fall. They find a nest under the leaves in the coldest winter weather, but come out on warmer days in search of food. It is not until spring that they make their cocoons and pupate, staying only a short time in this form before emerging as little white moths. There are other caterpillars, too, that have this same peculiar schedule, among which are several species found in the Arctic. Here, where one might think the bitter cold and long winter would necessitate spending this season in the pupal form, occur caterpillars that grow slowly during the short summer, stop growing at the half-way point, and go into a hibernation that



At the approach of cold weather, most caterpillars transform themselves into a chrysalis and hibernate until the following spring. This is not true of the familiar "woolly bear" caterpillar, however. With a warm fur coat, the woolly bear finds a nest under a leaf and emerges during the following spring to make its cocoon.

Some species of moths lay their eggs on water plants or rocks in water, and the caterpillars that hatch from the eggs feed on water-lily leaves or algae. Illustrated below is an English aquatic moth, the chinamark moth, with an actual wingspread of three-quarters of an inch.

sometimes lasts two years before they once again begin to eat and grow, and so reach the pupal state and then adulthood.

As for the caterpillar's diet, anyone at all familiar with Nature knows that caterpillars are quite particular about their food. Many species confine themselves to one plant, and will eat nothing else, while others will eat only related plants. There are a few carnivorous caterpillars, too, the most famous of which is the larva of a small butterfly known as "the harvester." This butterfly, orange-brown with black markings, frequents streams and marshy places where it likes to suck the honeydew exuded by aphids on the alder bushes. It lays its eggs on such bushes, and the caterpillars feed on the woolly aphids, or plant lice. In doing so, the caterpillars sometimes run afoul of ants that treat the same aphids as "cattle," and "milk" them of their honeydew. Ants have been known to kill such caterpillars in order to protect their "cows."

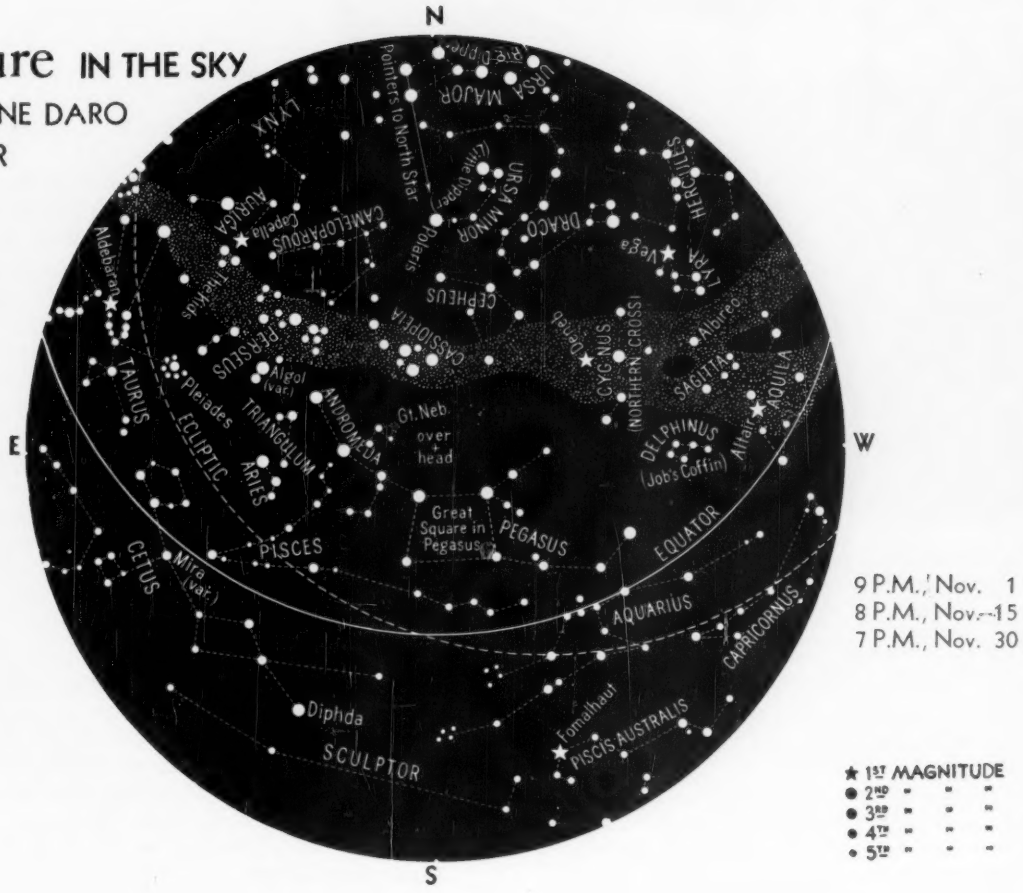
Exactly the opposite attitude is adopted by ants in the case of another carnivorous caterpillar. The larvae of some small blue butterflies of the family Lycaenidae themselves produce honeydew from a special gland, and are greatly prized by the ants, who take them into their nests and protect them just as they protect their aphid "cattle," even feeding them with the ant brood. So the caterpillar that started life as a vegetarian ends up as a carnivore, eating the offspring of its "protector!"

There is hardly a bush or tree leaf that is not appropriated by some species of caterpillar as a good meal. But what about the water plants? Surely the chance of drowning should deter the lowly caterpillar! But when we look, we find that this versatile creature has even ventured into the water to find food. There is a whole sub-family of aquatic moths, known to science as the Nymphulinae. The moth lays its eggs on water plants, or rocks that are in or near water. One species even goes into the water to lay eggs, using its wings as oars! The caterpillars that hatch from these eggs feed on plants like water lilies, or on algae growing on the rocks. Some of them build little cases of leaves, fastening the edges together so that the cases are watertight and retain a bit of air. Others have developed gills, and can breathe in the water. The caterpillar pupates in its nest, or in the water, and only comes out into the air when it becomes a moth.

So the humble caterpillar can live both on land and water, and in some cases it has been known to use the airlanes for travel. It does this by employing the same technique that is used by baby spiders. All caterpillars can make silk to a greater or lesser degree. If you walk in the woods in spring, you are likely to get not only spider webs in your hair, but caterpillars that hang at the ends of silken threads. A good stiff wind can send these little travelers soaring. This is just what happened a few years ago with the gypsy moth, which does not spread easily under ordinary conditions. It usually stays in the same tree, or group of trees, throughout the larval stage. But when several hurricanes hit our eastern States a few years ago, in addition to other damage, the high winds sent thousands of gypsy moth caterpillars sailing on their silken parachutes (*Continued on page 498*)

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

The Great Orion Nebula

ORION is without a doubt one of the most beautiful winter constellations. Its principal stars are so bright that they remain conspicuous even in partly cloudy skies.

According to Greek legend, Orion was a hunter who was placed in the sky after his death from a scorpion's bite. His two dogs (Canis Major and Canis Minor) are still with him, and the three constellations are grouped together. In old star maps, the outline of the hunter encompasses the four bright stars that form the outer quadrangle of the constellation: Betelgeuse to the north, Rigel to the south, Bellatrix to the west, and Saiph to the southeast. Three bright stars in the middle form Orion's belt, while a group of fainter stars aligned from the northwest to the southeast form the sword that hangs from the belt of the huntsman of mythology.

Good binoculars disclose that the center of the sword is not really a star, but a bright patch of luminosity. Large telescopes reveal it to be one of the most beautiful gaseous nebulae in our galaxy.

The Orion nebula was discovered in 1610 by N. Pereisc, and it soon became one of the favorites of visual observers. Its mottled surface, greenish in hue, inspired Sir John Herschel to liken it to "a curdling liquid, or a surface strewed over with flecks of wool, or to the breaking up of a mackerel sky." Before the advent of photography, observers made countless drawings in an attempt to analyze the structure of those wisps of nebulosity, and to compare the relative brightness of various parts of the nebula. They even came to the conclusion

OFFICIAL U. S. NAVY PHOTOGRAPH

The Orion nebula, photographed with the 40-inch Ritchey Chretien reflector of the U. S. Naval Observatory at Flagstaff, Arizona.

that rapid changes were taking place. Photography failed to confirm this, however, and astronomers could only ascribe the fancied changes to the inaccuracy of their visual methods.

In recent years, the Orion nebula has been studied with all the means of modern techniques and equipment. The observations have provided rich material that has contributed much to our understanding of physical processes in gaseous nebulae.

The luminous part of the nebula is actually a small section of a large dark cloud of dust and gas that extends from the southeast corner of the constellation in a northwesterly direction almost as far as Betelgeuse. The dark material becomes luminous in the vicinity of stars. The central part of the nebula owes its brightness to the multiple star Theta-One Orionis, which is embedded in it. The system of Theta-One Orionis consists of four stars commonly known as the Trapezium.

The stars of the Trapezium are so hot that the gaseous material surrounding them is ionized by the presence of ultraviolet radiation. Such ionized gas emits light of its own, giving rise to emission lines in the spectrum of the nebula. For this reason it is called an "emission nebula." A few bright patches in the outlying regions of the Orion Nebula do not exhibit the emission lines. The stars that illuminate them are considerably less hot than those of the Trapezium, and, in such cases, the gas shines merely in reflected light. Patches of this kind are known as "reflection nebulae."

Of all the emission nebulae in the Milky Way, the nebulosity around the Trapezium is the nearest to earth, at a distance of about a thousand light years. The brightest part of the nebula has a diameter of about twenty light years.

A sharp bright edge may be noted southeast of the Trapezium. Astronomers attribute the appearance of this bright edge to the collision of highly ionized gas particles with a dense dark cloud situated at the same distance from earth. This "silver lining" effect has been observed in a number of other gaseous nebulae.

In contrast, the very dense patch located to the east of the Trapezium does not have a well-defined boundary—no silver lining. It is assumed that we see here a dark dust cloud lying closer to earth than Orion, and merely hiding from view a part of the cluster of stars embedded in the nebula. The whole cluster probably occupies the same volume of space as the nebula itself.

These stars and the region that surrounds them have been under close scrutiny for the past few years. It is believed that we are witnessing there the early stages of stellar evolution. A star as hot and luminous as the center star in the Trapezium could not burn up energy at such a high rate for a very long time. It must have been formed fairly recently. On the other hand, these stars have rather small velocities in space, and thus they can not be very far from their place of origin. It is therefore reasonable to assume that they were formed in the nebula itself. If they had not been born there, one might well ask where else but in the nebula could be found a sufficient source of supply of stellar material. It has been estimated from observations in the radio frequency range that the dark cloud in the constellation of Orion contains gas and dust in excess of 100,000 times the mass of the sun. It would seem, therefore, that we have here a vast source of supply for the formation of stars, in view of current theories which hold that stars are born from the accretion of interstellar gas and dust.

Among the stars in the region of Orion are found also a large number of variable stars of the type called T-Tauri. These stars are irregular variables, characterized by a bright-line spectrum, and are often found associated with gaseous nebulae. Recent studies indicate that these characteristics may be attributed to the fact that T-Tauri stars are also relatively young.

The presence of the very hot stars and of the T-Tauri variables seem to point to the probable existence of a veritable "star factory" in Orion. How long has this factory been in operation? Astronomers at the Yerkes Observatory have been able to answer this question in a most ingenious way. They have shown that if one traces backward in time the path of the hot star AE Aurigae, one finds that it must have been close to the Orion nebula some two and a half million years ago. Another star, Mu Colombae, which moves in opposite direction from AE Aurigae with nearly the same high speed, was also in the vincinity of Orion at the same time. Both stars were probably ejected simultaneously from the nebula. On the other hand, another hot star

of high velocity, 53 Arietis, also is moving away from the nebula, but it must have been close to it nearly five million years ago. This would indicate that star formation in the Orion nebula must have taken place over a period of at least two million years.

In the month of November, the New Moon will occur on November 11, and the moon will be full on November 26.

Mercury will be an evening star, setting low in the southwest one-half hour after the sun on November 1, one hour after the sun on November 15 and 30. It will reach its greatest eastern elongation on November 20, but even on that date it will remain difficult to see.

Venus will be in superior conjunction with the sun on November 11, and therefore will be too close to the sun to be seen.

Mars will rise in the east one hour after sunset on November 1, at sunset on November 15, and will remain visible for the rest of the night. By the end of November it will set in the west about one hour before sunrise. On November 8, Mars will reach the point of its orbit closest to the earth. On that date it will be 45,310,000 miles away, and will be found south of the Pleiades.

Jupiter, in Libra, will be in conjunction with the sun on November 4. Therefore, it will be too close to the sun for observation during the early part of November. By the end of that month, it will be seen as a morning star, rising in the southeast one and one-half hour before the sun.

Saturn, in Ophiuchus, will set at about 7:30 p.m. on November 1, and by 6 p.m. on November 30. It will be low in the sky at dark and will be seen only by those who have an unobstructed view of the southwestern horizon.

The Leonid meteor shower will occur on November 16, with a maximum zenith rate of 20 per hour. Viewing conditions will be favored by the fact that the moon will be only five days old on that date.

Overheard

The other day, an acquaintance of ours had decided to visit the Museum of Natural History in New York City again. She had thought that, in the times of the Sputnik, the sight of the panorama of the Grand Canyon, or the cross-sections through the Sequoia trees would be a solace. But, unfortunately, none of them was on exhibit. Sadly, and in discord with the world, she descended to the basement to get her coat from the checkroom. The guard who took care of the checked-in property was discussing something with a couple. They were obviously from Texas, and even more obviously in a rush. They just wanted to "do" the Museum in the shortest of time and had asked the guard to advise them as to what "had" to be seen. The guard, an honest-looking man, had taken out a small leaflet which showed the "high spots" to be seen on each floor of the Museum, and when our acquaintance came near his booth, he was just saying to the startled Texans: "Well, and then there are the Dinosaurs! If you LIKE Dinosaurs!" E. E. Casparius

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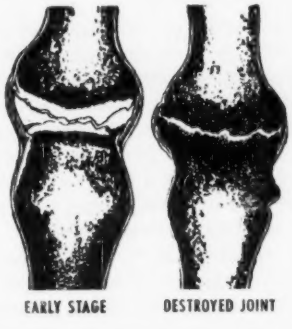

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Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

Fall Weeds In School

IS THERE A MORE glorious time of year than late summer and fall, when the ground is firm and dry, when the trees are taking on their most brilliant hue, when insect choruses are at their height, and when geese begin to go honking across the sky? Even the weed patches of waste ground are certainly more interesting than at other times of the year. It is with the understanding of these weeds and weed patches that the special educational insert in this number is concerned.

I might devote this page to the trite statement of the use of such weeds in classrooms as ornaments. I could ask you to list the weeds using the wind, animals and water to distribute the next generation away from "home base," and to consider the special structures they may possess to make such distribution possible. Much of that is already in books, or in the "state outline of study." I could point to the role of weeds in providing needed cover for "game" species that match their wits with gunners, contesting for life against man's machines, the skill and endurance of his trained dog and predatory desires to reduce a beautiful game bird climbing towards the sky into a mangled bunch of bloody feathers dropping to the ground. Education determines to a large extent what gives us satisfaction, and fortunately we do not all agree as to what is desirable. If each succeeding generation makes some progress towards demonstrably sensible behavior, we should be encouraged, providing the elements of destruction are not more accelerated than those devoted to improvement and maintenance of a wise balance of forces.

Horrible practice

I read recently of a practice chronicled by Theodore Roosevelt—one that he disparaged. It dealt with the hunting of deer by the use of fire and dogs, driving the animals to waterways where they could be overcome by men in swift canoes, who cut the animals' throats when they got near enough to shore so that they would not have to be hauled too far. We have come a long way from those times in many respects, but I wonder if we really have made as much progress in our treatment of fall weeds by the use of fire. Just as there may be something of the killer, and even of the torturer, in many persons, so there is something of the destroyer in those who cannot resist setting a lighted match to the tinder of dead weed-tops.

Schools might well spend some time trying to reach a reasonable conclusion about some of these urges. Can we condone cruelty? And what is cruelty, to kill quickly or to allow to starve because of short food supply? Can we use fire safely as a means of management, and, if so, what precautions must be taken? Is the fall a safer time, with its dried-out soil, than spring, with its water-soaked soil? But if we decide to use the spring, then what about the early-nesting birds that may have established homes by the time the weed-tops have become dry enough to burn?

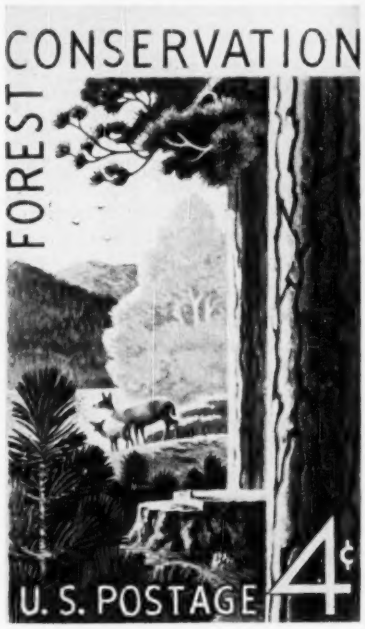
And while we are considering fall weeds why not systematically consider the role played by their seeds and fruits, their above-ground vegetative parts and the underground vegetative parts. It is easy enough to see flamboyant tops of cattail, milkweed and fireweed, and it is easy to see clutters of leaves and stems of weeds. But how many know much about the underground parts of these plants? If you take the time to inquire you will find that some have no significant underground parts, as is usually the case with most of the annuals. Others will have underground parts with main axes that are horizontal, and branch or are unbranched. These, of course, may be highly valuable soil anchors, particularly if they interlock and can resist the force of running water. Some of these, with their parts close to the soil surface, may well be injured by fire. Others, however, have roots that penetrate the soil deeply, do not offer great resistance to horizontal movement, but are most difficult to destroy by surface changes. It may surprise you to make a survey of the weeds of a weed patch and notice that frequently these different types are mixed so that if one type is reduced in effectiveness by catastrophe another stands ready to take over its responsibility. The niceties of some of these mixtures and adjustments are among the factors that make some believe that there may be a plan back of it all.

In the weed-tops

Of course weed-tops harbor the different stages of many insects and other animals over the winter, and may sometimes be a factor in the prosperity of cultivated plants grown close by. Take almost any fall weed and make a study of it from top to bottom. You will see many interesting things. The top may have provided supports for the webs of spiders, or may provide the take-off point for ballooning spiders whose webs may streak the fields with finest silver. Seeds and fruits may make use of the elevation and the swaying motion to get the next generation farther away. Lower down, the stems may be hollowed or swollen, providing shelter for hibernating creatures large and small. Most of these, of course, can be wiped out by a fire. Some, however, provide really challenging ideas to our reasoning. Why should a spider, for example, choose to place its cocoon high in a weed-top at a time when winter is approaching. The answer is simply that it makes no difference to the garden spiderlings, which come from the eggs in the severest of weather and begin their development at a time of year which to us may seem wholly unreasonable.

Of course, the underground parts of fall weeds may be a haven for many kinds of creatures. There they may find not only mechanical shelter but an abundance of food as well. Try digging with a fork in almost any weed patch to see just how crowded the underground areas may be, and notice how frequently this underground tangle is not composed wholly of fibrous parts but frequently of swollen food-holding parts as well.

These are only a few of the many things that make a patch of fall weeds interesting to our sense of beauty, intriguing to our management designs, and challenging to our reasoning powers. A weed patch is a society of organisms, a society that is obviously reasonably successful and stable. It is worthy of careful study, whether you are in school or out of it. Give it a try, just to see how right I may be, or, if your disposition dictates, how wrong I may be. Either way you may learn something worth while.



Forestry Stamp Issued

On October 27, the first United States postage stamp publicizing forest conservation was issued at Tucson, Arizona. Of four-cent denomination, the new forest stamp is printed in yellow, brown, and green, and depicts, in vertical format, the major forest conservation features—wise use of timber, watershed protection, and home and shelter for wildlife. Appropriately, the stamp was issued on the day of the one hundredth anniversary of the birth of President Theodore Roosevelt, during whose administration nearly 150 million acres of public domain were introduced into our National Forest system; while at the same time, the American Forestry Association was in session at Tucson. A special cancellation, showing Smokey Bear urging folks to "Keep America Green," was used on the first day of issue.

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THE Nature CAMERA

By EDNA HOFFMAN EVANS

Animals As Actors

SUMMER DAYS ARE WANING AS I WRITE this, and winter will be almost here by the time it appears in print. However, part of the pleasure one gets from doing things is the remembering of them after they are done. Photographs help the memory and add to the pleasure of remembering.

It is pleasant to remember that during June, July, and August I ran a summer boarding house for actors. I ran a summer theater, too. I was set designer, stage hand, electrician, director, costumer, impressario, and all the other people who help to make a stage production. Aside from all that, I had to catch my actors, keep them fed and comfortable and, finally, take them back from whence they came when I dismissed my theatrical company.

The summer was somewhat of a continuation of the "silly season" I wrote about several years ago, when I used lubber grasshoppers for models. This time I moved up the zoological scale and specialized in amphibia and reptilia. My actors were toads, frogs, snakes, and turtles, with one detour back to invertebrates for some fiddler crabs. Some were more than a little reluctant, but in the end they all posed for me and were none the worse for it.

Toads, I think, make adorable models. Not all my friends agree with this opinion; some mutter about warts, and others just look their disapproval in silence. But I keep right on liking toads more and more. It is probably a good thing I was not born three hundred years ago when toads were reputed to be ugly, venomous, and helpers of the Devil. They were thought to be the allies of witches and sorcerers, either as "familiars"—evil spirits with powers to harm the innocent—or as unappetizing items in various kinds of witches' brews. Had I lived in those superstitious days and felt as I do about toads, I probably would have wound up being dunked in the village pond as a witch, or have met an even more unpleasant fate. Thank goodness, I live in this gentler age of guided missiles and sputniks.

Pleasant subjects

Have you ever looked a toad in the face? Have you ever picked one up between your thumb and forefinger, or let one sit on your hand and look at you? Toads have the pleasantest expressions—their big mouths turn up at the corners in the friendliest sort of grin, and if you watch long enough, a toad is sure to wink at you.

Frogs make fairly good models, too, but they are inclined to be "jumpy." Toads just hop, and you can catch them without staging a cross-country race when they jump off the stage. Frogs are less likely to stay put, and when they jump they really achieve distance. Frogs are damp and clammy, too, and if they jump against your backdrop they leave wet spots that stain and discolor. Toads are dry and clean, and their rough skins are not at all unpleasant to the touch, once you forget that silly old superstition about warts.

I catch most of my models on the road. The best time to hunt them is on a summer evening, an hour or so after dusk. Summer rains bring them out in large numbers, and I often hunt during a shower. The road should be paved, but a little-traveled one. Too much traffic plays havoc with the wildlife, and is likely to do the same for would-be collectors, too.

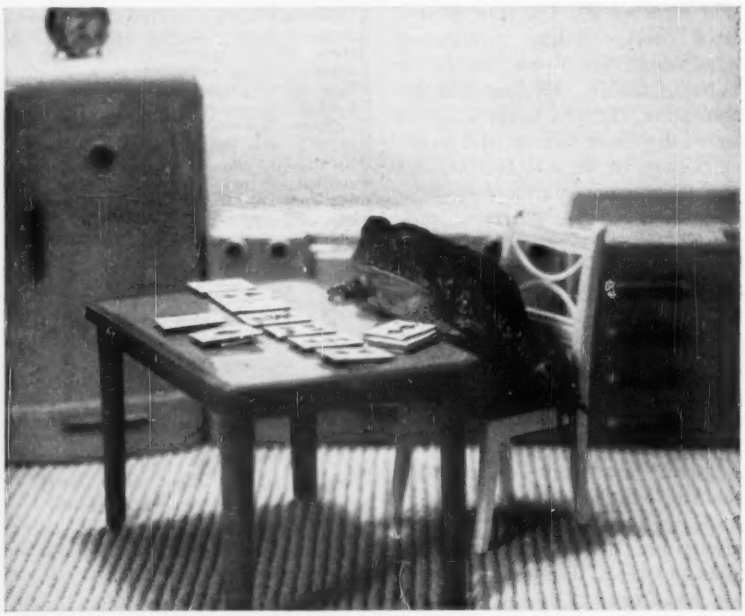
I drive slowly, ten miles per hour, and watch the road as it comes under the headlights' beam. Dim lights are best; bright lights shine too far ahead.

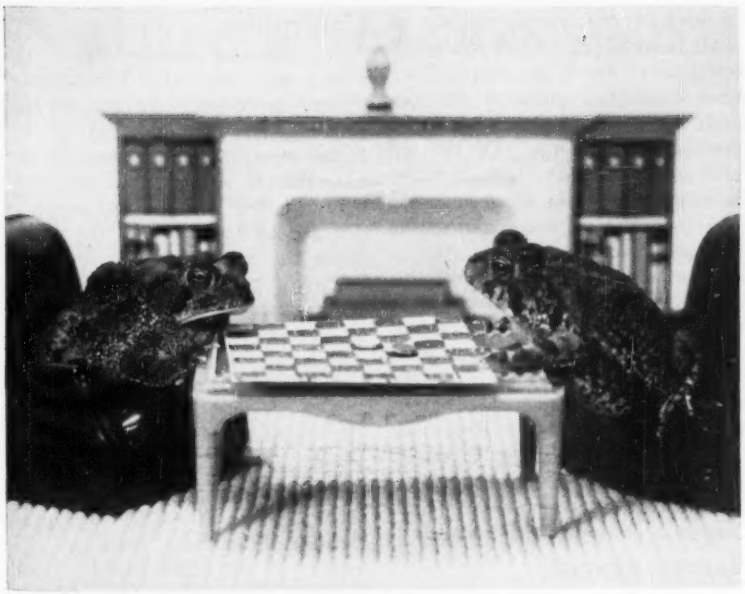
It is surprising the number of small creatures one can see on the road if he watches for them. I can spot small tree frogs, toads, frogs, snakes, and mouse-sized mammals. On rainy nights the insects are not so visible, but on dry nights the spiders' eyes shine like diamonds as they reflect the headlights.

Catching the models

When I see a potential model I stop the car, climb out with flashlight in hand, and try for a capture. The headlights seem to exert a hypnotic influence, which is furthered by the flashlight. Some "come to" and hop away before I can get a hand on them, but others just squat closer

One toad is easier to control than two or more. But, just in case this one decides not to finish the game of solitaire, the cards are anchored with Scotch tape to keep them from scattering when the animal hops.





When I was through photographing the toads in natural surroundings, I could not resist trying them in less natural settings. Which toad do you think will win the game of checkers?

to the paving and wait to be collected. On such expeditions I carry a number of clean pickle jars to use as collecting bottles.

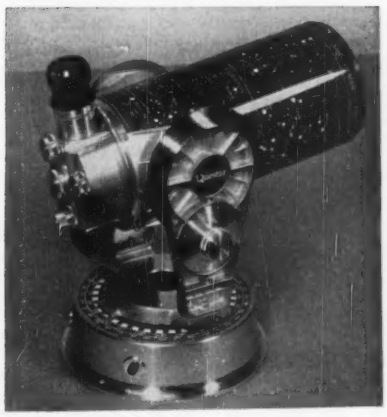
Back home after a collecting trip, I transfer the catch into more suitable containers. Frogs get water, toads get moist sand, snakes usually stay curled up in a bottle, but all get air and moisture and, when possible, food to their liking. I try not to keep them caged too long, for some creatures are hard to feed in captivity. The toads, being insect eaters, are contented boarders, and they thrive on a diet of grasshoppers, beetles, and whatever other bugs I can capture. When their appetites got too large to be supplied from the yard, I took my bug-collecting bottle over to the shopping center where the neon lights attracted my quarry for me. I used the table-top technique in arranging and directing my stage productions—the best and most comfortable set-up I have ever put together. I could sit down while I worked, and almost everything was within reach without the need for moving. I used an overstage photoflood, aided by a second photoflood in a gooseneck lamp from the front, and a third photoflood from below the stage as a backlight.

From the stationer I bought a sheet of sky-blue cardboard to use as a background, and it served several purposes: 1. a natural looking "sky" background (pretty in color and neutral in black-and-white); 2. a deterrent to escape-minded models; 3. a windbreak, since the stage was set up under the carport, out-of-doors. By plugging all three lights into the same socket, and by tying a longer string to the original pull cord, I could control all my lights at once, or manipulate them individually when I wished.

The camera was set on a tripod and focused on the stage, the timing and exposure were calculated, and the controls set. After that I did not have to think about them and could devote my full attention to keeping the models under control. When one is dealing with models that are likely to hop out of the picture at any moment, he does not have time to cope with changing photographic details.

Accuracy important

I have learned, from observing judges' reactions to Nature slides in contests, that surroundings must be accurate. Thus, for shots intended to be natural, I use soil from the garden, spread on a flat tin tray. If slightly moist and about an inch deep, it will hold and keep plants looking fresh and natural for the duration of a photographic session. Small twigs, bits of bark, leaves, pebbles, and plants can be arranged so as to make the setting natural. But there are two things to remember: do not make your setting so



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natural that your model's camouflage coloring blends and renders the subject invisible. Second, watch so that the twigs and leaves are not sprouting from the subject. I have, for example, one slide in which my toad model seems to be wearing a bright green tail of feathery nut grass. I am afraid that such an arrangement is totally lacking in judge-appeal.

When I was through taking the toads in natural surroundings, I could not resist trying them with doll furniture. I took color shots and black-and-white both, and I, for one, find the results quite amusing. Of course, toads do not sit down as people do, and their bodies do not adjust to furniture as well as the grasshoppers did. But in positions and settings where they could, the toads posed amiably.

One toad is fairly easy to control. Two toads are likely to go—simultaneously and unexpectedly—in opposite directions, knocking down scenery and scattering properties as they depart. For that reason Scotch tape came in handy to anchor the most movable things down.

It was not necessary this time to "cool them off" in the ice box before trying to pose them. Since they came out of their terrariums somewhat sandy, I first dipped them in a dish of water and then wiped them off with a paper towel. Cold water made them no calmer than room-temperature water; patience in catching them and putting them back as often as they hopped was the best method. I never tried posing more than three toads at a time—two made enough trouble—and occasionally a model would hop away and disappear into the shrubbery before I realized it was gone.

The camera settings

With the lighting under control via photo floods, I could take black-and-white pictures (using Super Pan Press film) at 1/100 second with a lens stop of f/14. Using Ektachrome film the speed was 1/50 at f/6, or 1/25 at f/9. By using full bellows length, or an extension tube, I was able to bring my lenses within about 16 inches of the actors. After that, I could figure out things for them to do, and then persuade them to act.

This method—live models in table-top setting—has a great deal to offer the hobby photographer. It challenges his ingenuity, both artistically and mechanically. He can work out effects or rig up gadgets to his heart's content. It is a good technique to use in the wintertime, when conditions outdoors are too much on the chilly side for comfortable photography. Of course, there are no toads available as models, but one can find other subjects, even though they may have to be inanimate ones.

Incidentally, the table-top technique can be used to produce some interesting and original Christmas cards. And, speaking of them, it is high time to be buying materials and getting ready to make your Yuletide greeting cards. If you do not yet have a satisfactory negative, get busy. Time goes fast from here on, and the shopping days before Christmas get fewer and fewer.

ANOTHER REMINDER

Deadline for the Fourteenth International Chicago Nature Salon will be January 17, and the show will be held at the Chicago Natural History Museum, February 7 to 27. Each person may enter four prints and/or four slides. Entry forms are available this year from Mr. Wendell Dahlberg, 1121 W. 93rd Street, Chicago 20, Illinois.

New Vocational Course

A new vocational course for in-service and home study training is being offered by the National School of Forestry and Conservation, of Minong, Minn., which points out that conservation programs are expanding faster than trained manpower is becoming available. The School offers technical training in fish and wildlife conservation, soil and water conservation, and forestry, with lessons designed for both workers already in the field and for young men seeking to train themselves for careers with forestry, wildlife, and State and national agencies. Inquiries concerning the courses should be directed to the School field headquarters, Wolf Springs Forest, Minong, Minnesota.

Federation Meeting

The twenty-third annual convention of the National Wildlife Federation will be held in New York City February 27 to March 1, 1959, it has been announced. As in the past few years, the Federation's convention will be held immediately preceding the North American Wildlife Conference, which is scheduled, in 1959, at the Statler Hotel in New York City, March 2 to 4.

Caterpillar

(Continued from page 490)

over a wide territory. The ensuing differences between government entomologists, bent on spraying infested areas, doubtful conservationists, and an angry public are still occasionally reported in our press.

These are but a few of the many facets of a versatile insect form, so when you hear someone refer to the caterpillar as a "weak, defenseless, or vegetarian" kind of life, the chances are that the speaker is not well versed in entomology!

Park

(Continued from page 488)

Monument, and the Channel Islands National Monument, both in California. In the Palau Islands, Trust Territory of the Pacific, the Eil Malk area has certain under-sea sections that are to be maintained in their original state.

In order to activate the Exumas park project, a formal proposal, signed by an impressive list of Bahamians and Americans, has been submitted to the Governor of the Bahamas. He, in turn, has referred it to the Assembly for approval. Because several of the islands are still Crown land, the project will doubtless have to be considered also by the home government in London.

Fortunately, no opposition to the project has developed from any quarter. So, the first land-and-sea park is likely soon to become an official reality, preserving another bit of the earth in its natural state, and refuting again those who would have us believe that "most conservation is merely a rear guard action."

Few Legs Missing

The word "millipede" refers to an animal with a thousand legs, although no species of invertebrate has as yet been found with that many. But an investigator for the Smithsonian Institution in Washington, D. C., has recently discovered in Panama a worm-like animal that comes fairly close to qualifying. The body of this creature consists of 175 segments, each segment with four legs. H. F. Loomis, a former Department of Agriculture scientist and specialist in this form of life, found this many-legged specimen on Barro Colorado Island, the Institute's tropical life preserve in the Canal Zone.

Nature IN ROCK AND MINERAL

By PAUL MASON TILDEN

The Stony Strangers

OF THE THREE-THOUSAND-ODD PAGES OF English words in Webster's big dictionary, only a little more than three pages are given to words that begin with the letter "X." And of those, a considerable fraction have their roots in the Greek word *xenos*, the guest or stranger. Mineralogists and geologists both have helped themselves liberally to this Greek word in their search for pegs on which to hang some precise scientific meanings.

For example, a xenocryst is a crystal that seems out of place in the rock where it is found. Xenon, the heavy atmospheric gas, is rare enough to be called a stranger, and a xenomorph is a crystal that does not show its ordinary form, but has assumed a strange one.

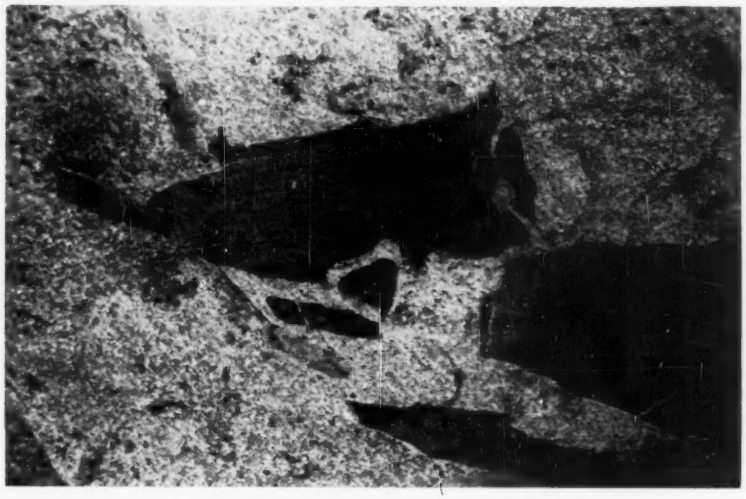
Then there is the xenolith, the stranger stone. If you happen to live in an area that has been intruded by granite dykes—or even some basic, or "trap" dykes—the chances are that you will be able to find some of these strangers for yourself. You will find also that xenoliths are much easier to photograph than they are to collect, unless drillers' tools and dynamite are part of your ordinary field equipment!

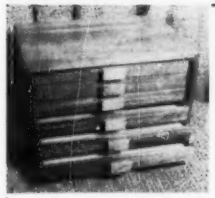
The invading rock

Let us suppose that you have located an area of sedimentary or metamorphic rock that has been intruded by a mass of granite, and where the line of contact between the two is

(Continued on page 501)

At the sea cliffs near Black Wood campground in Acadia National Park, the Cadillac granite has invaded a dark, basic rock, producing thousands of xenoliths that sometimes look like stony jig-saw puzzles.





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Song Birds Die

There is an interesting and rather distressing story by Amelia R. Laskey in *The Migrant*, quarterly journal of the Tennessee Ornithological Society for December, 1957, concerning the havoc wrought among migrant song birds by the new extremely high type of television tower currently being favored by the TV industry. For example, during the 1957 autumn migratory season, the total kill of one 1000-foot television tower in the neighborhood of Nashville was 704 birds of some 67 species. The author of the article has found that the greatest killers among TV towers are those with the most supporting cables, as might be expected; and that towers with wider bases and fewer cables are correspondingly less deadly. Secretary of the Society's journal is Miss Ruth Castles, Forest Hills Apt., Hillsboro Road, Nashville 12, Tennessee.

Rock and Mineral

(*Continued from page 499*)

revealed. If the intrusion has produced xenoliths, which are shattered fragments of wall-rock that are brought up with the molten intrusive, they are most likely to be found in the granite (the intruding rock) along and adjacent to this line, as chunks of darker-colored rock standing out against a lighter background.

The chunks may be jagged in outline, faithfully preserving the original forms of shattered pieces, or they may be somewhat rounded by partial melting. Often the original fragments have been reduced to nothing more than formless blobs, grotesquely stretched and squeezed, while now and then a large fragment has been shattered into smaller pieces that clearly could be fitted together like the pieces of a jigsaw puzzle, except for a few inches of granite—a kind of frozen puzzle!

While the rockhound finds the xenolith entertaining and instructive, the mine operator, especially the operator engaged in mass removal of ore, like the feldspar quarryman, finds it more productive of harsh language than entertainment. Getting rid of a "horse"—as the miner calls a big xenolith—means raising a goodly weight of worthless rock, and the mine owner can see nothing entertaining about *that!*

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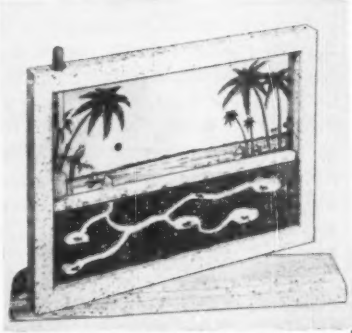

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Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

African Sleeping Sickness

1. The Disease

THE GREAT tribe of flies has posed many of the gravest problems in public health and has taken a fearful toll of human lives throughout the ages. Malaria and yellow fever are two of the best known fly-transmitted diseases but, although of less world-wide importance, African sleeping sickness is more spectacular, and has received much attention in both the scientific and general press.

Popular names for ailments are likely to stress symptoms, and many quite different diseases commonly have similar symptoms; hence "sleeping sickness" may connote unlike pathologies to different people. The African type is a distinct condition, not to be confused with American outbreaks of encephalitis, a virus disease that is wholly separate from the protozoan disease of Africa. Recently, the parasitologist has come up with an excellent and precise method of designating the ills of man and other animals that are caused by animal parasites; he takes the name of the genus of the pathogen (disease-producer)and adds the suffix *iasis* (Greek, a state or conditions; pronounced eye-a-sis, accent on the "eye"), as had been previously used in such medical terms as elephantiasis and hypochondriasis. Since African sleeping sickness is caused by protozoan organisms belonging to the genus *Trypanosoma*, the disease is now known as trypanosomiasis; pronunciation, trip-a-no-so-ma (accent on "so") and trip-a-no-so-mi-a-sis (accent on "mi"). These are long jaw-breakers, to be sure, but contribute that all-important element of precision in a universal language, so essential in modern science.

Differing forms

Just as one finds variants in a genus, classified as distinct species, so among pathogens these species may produce somewhat different forms of the disease, and by adding the species name we can achieve a further breakdown. Thus there are distinctions between *trypanosomiasis gambiense* and *t. rhodesiense*, two types of the human disease that are due to different species of the parasite, occur in different geographic areas, and are transmitted by different species of tsetse flies. The fly is known as the *vector*, the one that carries the pathogen from one host to another.

Parasitologists recognize that when a pathogen causes severe symptoms and high mortality, the partnership between parasite and host is a realtively new condition, to which neither organism has become adjusted. When a host dies, all its contained parasites die, too; a circumstance that does not benefit the parasite at all. Given time, the host will develop at least a toleration, and the parasite will have less disastrous effects.

In the case of trypanosomiasis, the infection of African antelopes has gone on for so long a time that these animals and their protozoan fauna have adjusted to one another in a live and let-live fashion; likewise, there is such an adjustment between the trypanosomes and tsetse flies, the result being that protozoan, insect, and mammal all flourish. The trypanosome undergoes one stage of its developmental cycle in the fly, another in the antelope. Since the latter is the natural mammalian host that can harbor the infection without showing symptoms, but can therefore serve as a source from which man can be infected, the antelope is called the *reservoir*. Indeed, in one form of the disease, man himself is considered the reservoir.

The fly bites, its aim being a meal of blood, and there is, of course, slight pain and considerable annoyance. It is a predator, just as much so as is the tiger or the shark; but it is satisfied with a minute quantity of the blood of its victim. If it contained no parasites, there would be no more than trivial damage.

The natural thing

Some persons, who have had no formal biological instruction, may lapse into the fallacy of thinking of the fly as a sort of demon—a vindictive and implacable enemy of both antelope and man, doing its insidious work in a malevolent spirit or in furtherance of some fatalistic design. As a matter of fact, the fly is totally unaware of whether it does or does not harbor any parasites; it is intent only on getting food, like the rest of us, and a meal of blood is its natural food, although it also sips nectar to some extent. The case is no different from that of a highly civilized man or woman who, going into a restaurant and ordering a juicy steak, in effect has hired someone else to butcher a steer instead of going out and killing it in person. Squeamish people prefer to ignore the facts of life.

The trypanosome is but a single-celled organism, but it, too, has its own way of making a living. The evidence shows that all of them began as parasites of insects. They must have wreaked considerable damage and killed many of their fly hosts during a long period of adjustment, but today the fly suffers not at all and pursues its life habits just as well with or without its complement of unicellular freight. Upon being injected into the blood of a warm-blooded animal like an antelope, the protozoan found itself in a new environment, and many must have perished. But a few slowly adjusted the life cycle to the new conditions, meanwhile raising havoc with the new host. This is the case now with man, a johnny-come-lately on the scene. Long before the advent of man, the protozoan-insect-antelope mutualism had reached a state of equilibrium. But a new host has no immunity, no protection, and so the breeding of great numbers of one-celled animals in the bloodstream in such a case is an event that produces dire consequences. It is significant that the black man in Africa, having been exposed longer than the white man, suffers somewhat less severely.

Antibodies produced

Given enough time, the blood system of man will respond to allergies and foreign invaders by the

production of antibodies, designed to neutralize the damage. Many centuries hence, such could be the case with trypanosomiasis, and man could live a normal life, even with a circulation loaded with protozoans. But at the present time these new parasites cause violent symptoms, then invade the central nervous system and bring on death.

While there are great variations in the course of the disease, trypanosomiasis, an average picture is this: an itching develops at the site of the puncture, and often a maroon-colored swelling appears. A few days later there is fever and headache, and then an increasing debility and enlarged neck glands. This last is *Winterbottom's sign*, an early means of diagnosis. Resistance to other diseases becomes markedly lowered, and frequently muscles become tender. A generalized rash appears, and there is loss of vitality, including, in women, the ability to bear children.

Eventually, the parasites invade the cerebrospinal fluid of brain and spinal cord, and sleeping sickness follows, with profound depression of both physical and mental functions. The patient drifts into a stupor, and will not even arouse himself sufficiently to take food. The body becomes emaciated; there are tremor, convulsions, and even mania, and finally the hapless victim dies in a complete coma, an inevitable result in untreated cases that have progressed to the stage where the nervous system is involved.

Diagnosis in early stages is difficult, as it is often not possible to demonstrate the parasites in blood smears. Puncturing an enlarged neck gland and smearing the fluid may yield more certain results. Sometimes it is necessary to inoculate a laboratory animal, and produce the disease in this second host in order to confirm its positive presence in the first. Thus, diagnosis may be elaborate and costly, and may seem over-cautious to the uninitiated; but it is highly essential to have a correct diagnosis for two principal reasons. First, the symptoms may often resemble those of malaria, syphilis, or other morbid conditions; and second, the methods of treatment differ markedly and involve certain risks, not to be undertaken lightly.

Treatment consists in injecting a number of new drugs, many of which have dangerous side effects. Antrypol, pentamidine, and Lomidine are some of those used to combat the earlier stages of trypanosomiasis; an arsenic preparation, Tryparsamide, after the parasites have invaded the central nervous system. This last is highly toxic and dangerous, but the only effective remedy known. To kill living organisms in the blood or cerebral tissues without also killing the patient is indeed a delicately-balanced and difficult feat.

Prevention is, as always, the better way; but the problems of ridding the country of either or both antelope or fly are quite complex. Clearing brush, burning, trapping, spraying, wholesale removal of antelopes, and forced mass migrations of the human population, are all partially effective, but one hundred percent eradication is a dream of the future. Vast sections of Africa are still closed to human habitation by the presence of flies, and we are far from having beaten the problem.

Should natives attempt to move into these areas with their domestic animals, both the people and their horses, cows, camels, and pigs will die by the thousands, while the antelopes, zebras, giraffes, lions, and other large mammals continue to flourish. As Chandler has said, for the bulk of Africa "it is a case of game and tsetses or man and cattle—it can't be both," and "it is a. . .choice between preserving the game for hunters and naturalists or making land available for development by man." Let us hope that some more effective means of eradication will be discovered before such an ugly decision need be made.

In our next issue we shall discuss the trypanosomes, and explain how the amateur microscopist may obtain living and harmless species for the observation of these tiny but terrifying scourges under his microscope.

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Book Reviews

MANY FINE new texts in general zoology have appeared in recent years. When compared with the best of twenty or even ten years ago, they are for the most part far superior as educational tools, and show an extraordinary advance in the arts of writing, illustrating, and printing a book of this character. Some of the leaders will be reviewed briefly here, and others discussed later.

General Zoology, by Gairdner B. Moment, Goucher College. Houghton-Mifflin Co., 2 Park St., Boston 7, 1958. Pp. xiv, 632; figs. 545. Colored phylogenetic chart front and rear inside covers. Price $7.50.

Written by a scientist of distinction, experienced in general text work, who displays remarkable ability in selecting and organizing material; presents it with authority and charm. Includes latest findings in all fields; interweaves exposition of animal phyla with thorough coverage of principles—a new method handled with great success. The only American text we have seen that adopts the phyletic relationships proposed by Jovan Hadzi, in which primitive acoele turbellarians are derived from multinucleate ciliates, the Platyhelminths in turn giving rise to Coelenterates and Ctenophores. Modern format, good clear type, set two columns per page. Copiously illustrated with photos and with many expert and beautiful drawings by Elmer W. Smith. Natural history, behavior, and ecology stressed in addition to structure and functions for all groups. Many classical experiments included; scientific method emphasized. A fascinating book, certainly among the top two or three now current.

Zoology, Winchester & Lovell, Van Nostrand, reviewed in this department, Feb., 1956.

Zoology, by Alfred M. Elliott, University of Michigan. Appleton-Century-Crofts, Inc., 35 W. 32d St., New York 1, 2d edition, 1957. Pp. x, 746; figs. 509. $7.00.

Expertly written, evolution as central theme. Sufficient coverage of structure, but emphasis on functions and broad concepts, as continuity of life, scientific method. Chapters well integrated with each other and with illustrations. Large readable type set two columns per page. Great array of superior illustrations; fine, large photos; many notable stereograms and cartoons, for which author is well known. One of the best of newer texts, thorough, modern, and suited to all classes of students.

Kinships of Animals and Man, Ann Morgan, McGraw-Hill, reviewed in this department, Aug.-Sept., 1956.

(Dr. Corrington's reviews of new texts in general zoology will be continued in the December issue of *Nature Magazine*.)

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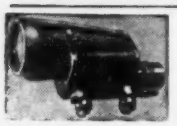

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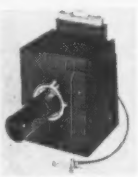

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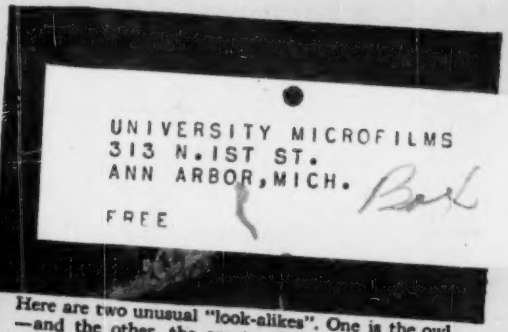

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